SHOUT
SHARE
IT

PROFESSOR BALFOUR,
ROYAL BOTANIC GARDEN,
EDINBURGH

F39 A

EWFD

PROFESSOR BALFOUR,
ROYAL BOTANIC GARDEN,
EDINBURGH

A

DISSERTATION

ON

BOTANY.

By CHARLES ALSTON, M.D.
THE KING'S BOTANIST IN SCOTLAND,
FELLOW OF THE ROYAL COLLEGE
OF PHYSICIANS, AND PROFESSOR
OF MATERIA MEDICA AND BO-
TANY IN THE UNIVERSITY
OF EDINBURGH.

TRANSLATED FROM THE LATIN BY A
PHYSICIAN.

LONDON:
PRINTED FOR BENJ. DOD, AT THE BIBLE
AND KEY IN AVE-MARY-LANE.
MDCCLIV.

1.65

THE TRANSLATOR's PREFACE.

AFTER the reſtoration of the *Greek*, *Roman* and *Arabian* learning, in the latter end of the fourteenth, or beginning of the fifteenth century, *Botany*, with moſt other Arts and Sciences, from the diſcoveries and improvements made by the laborious reſearches of curious and ingenious men, put on a new face; and, though ſtill very imperfect, it now flouriſhes and is adorned with the moſt conſpicuous excellencies. The ſum of the antient botanical treaſures might have been retained by a ſtrong memory; but, ſince the times

of barbariſm, they have been inriched with a vaſt number of new plants by many botaniſts, ſome of the lateſt of whom are *Sloane*, *Sherard*, *Plukenet*, *Chomel*, *Plumier*, *Petiver*, *Dale*, *Moriſon*, *Tournefort*, *Breynius*, *Herman*, both the *Commelines*, *Rheede*, *Rumpfius*, *Ray*, *Dillenius*, *Ruppius*, *Boerhaave*, *Scheucher*, *Vaillant*, *Magnol*, *Montius*, *Pontedera*, *Michel*, *Houſſton*, *Linnæus*, &c.; their general ſtructure has been unravelled, and the uſes of their parts pointed out by the two great vegetable anatomiſts, *Malpighius* and *Grew*; various ways of methodiſing them, which from their multitude became very neceſſary, have been contrived, the manner of cultivating a conſiderable ſhare of them deſcribed, and the virtues of ſeveral found out: yet, doubtleſs, an indefinite number of vegetables remain undiſcovered in all parts of the world.

BOTANY, therefore, appears to be an Art of prodigious extent: And if its antiquity, the dignity of the perſons who have employed themſelves in it, and the great uſefulneſs, variety and delight it affords, render it valuable, noble and honourable,

honourable, it claims all these advantages in the highest degree. Its rise may be deduced from the creation, its progress and fates traced through succeeding ages, and its history brought down to this day. *Adam* is reckoned to have been the first, and a most intelligent Botanist; Kings, Princes, Heroes, Generals of armies, Philosophers, Divines, Physicians, Poets, &c. have studied this branch of natural knowledge; many of the most necessary and comfortable human enjoyments are derived from its instruments; life is sustained, and health is preserved by some of them; and diseases are cured by others: Moreover, the easy culture of plants is extremely wholesome and amusing, and the examination of the manifold states and beautiful changes of vegetables, whose variety is almost infinite, growing in gardens, fields, hills, valleys, woods, forests, marshes, lakes, rivers, the sea, on rocks, on one another, &c. has a powerful tendency to make men patient of toil and labour, solid and serious; to infuse the most desirable serenity and composure into the mind; and to fit it for a more relishing and successful application

plication to other buſineſs; while it yields ſuch an high ſatisfaction and pleaſure as can be felt by thoſe that are converſant therein, but cannot be juſtly painted in words, though embelliſhed with all the flowers of rhetoric.

IT is ſufficient to recommend to the public the following Diſcourſe, that its author is the celebrated Doctor ALSTON, who is well known to have been many years one of the Profeſſors of Medicine in the Univerſity of *Edinburgh*, teaching in the winter, that branch of the ſcience called the *Materia Medica*, and in the ſummer, *Botany*; the cultivation of both which parts of medical knowledge has been the principal ſtudy of his life. His great natural abilities, learning, univerſal knowledge, ſagacity, accuracy, candour, caution, ſolid judgment, indefatigable induſtry, inventive inveſtigation, ardent love and ſteady purſuit of truth, and ſacred regard for the public emolument and utility, joined to that tempering ſweetneſs of diſpoſition, which is very predominant in him, have enabled him by a long courſe of experience in practice, experiments

periments and obſervations on natural bodies, much ſpeculation, reading, deliberation and reaſoning, to make uſeful improvements and diſcoveries, and detect egregious errors in the two above-mentioned provinces of the medicinal art, than which parts of medicine none are more fundamentally beneficial and entertaining, and yet none have been hitherto leſs ſtudied and leſs improved. His moſt elegant Diſſertation on *Opium*, in the *Edinburgh Medical Eſſays*, Vol. V. Part 1. that on *Quick-Lime* and *Lime-Water*, his *Index Medicamentorum Triplex*, and the ſubſequent treatiſe taken from his *Tirocinium Botanicum Edinburgenſe*, are confeſſedly ſubſtantial proofs of his ſhining talents and merit, and do him ſo great honour, that the learned vehemently deſire and impatiently expect to ſee publiſhed by him a larger work, of which ſome of theſe leſs performances may perhaps be looked on as detached parts. I hope the Profeſſor will pardon me for attempting to delineate a rude portrait of his illuſtrious endowments; which, though it is neither equal to the original, nor re-

conciliable

concileable to his delicate modeſty, may ſhew my perſonal eſteem of him, and that gratitude to him, for the benefit I have reaped from his already publiſhed tracts, which is a debt of common juſtice.

THE Doctor prefatorily obſerves, that in the botanical Diſſertation, the main arguments of the general Lectures, which he gives previouſly to the Demonſtration of the plants in the Phyſick-Garden, are briefly handled; that ſtudents may therefrom acquire a juſt and worthy idea of Botany. He alſo recites the following quotation: "Every ſtudent of medicine, at "the beginning of his application to that "ſcience, ought always to exerciſe himſelf firſt in this ſtudy; ſince it is the "moſt natural to the human genius, in "reality very eaſy, and entirely agreeable "to a mind free from weightier care. It "is, indeed, a publickly conceived and "ſtrong vulgar notion, that it is ſufficient "as it were for a Phyſician to learn to "know faithfully a few plants, poſſeſſed "of healing virtues, and fooliſh to purſue glory in ſurveying the reſt, as it is "uſeleſs. Yet this opinion, I think, is

"far

" far from being true: nay, on the con-
" trary, I believe that notwithſtanding
" ſtudents of phyſic ought indeed to be
" chiefly acquainted with the plants dig-
" nified for their approved uſes; at the
" ſame time, as they have opportunity,
" they ſhould, though more ſlightly, con-
" template all others." *

I ſhall only add, that in this tranſla-tion, an explanation of ſome of the words and terms, whoſe meanings are either ob-ſcure, or uncommon, is here and there inſerted.

* *H. Boerhaave Index alter Planta-rum, quæ in Horto Academico Lugduno-Batavo aluntur. Lugd. Bat.* 1720, *in* 4to. *Vid. præf. p.* 10.

A DISSERTATION ON BOTANY.

1. THE Profeſſors of this art have long enough complained, that the knowledge of plants is neglected by moſt ſtudents of medicine, deſpiſed by many, and as it were hated by ſome phyſicians. And it is indeed to be regretted, that even at this day, by reaſon of the immenſely multiplied names of plants, uncertain terms, theories, methods, and idle philological controverſies about them, it does, in ſome meaſure, ſeem to be unworthy of the regard of men, who excel in learning or genius.

Yet, ſince the Doctrine of Herbs, or Botany, is that part of natural knowledge, which, beſides the names as well as methodical diſtribution of vege-

tables, treats of their external and internal ſtructure, their vegetation, nutrition, fructification, uſe, virtues, culture, and the like; the contemplation of theſe things may either lead to the veneration and love of the great Creator, or redound to the advantage of mankind.

2. Neither my abilities, nor the nature of my deſign, permit me to diſcourſe on the parts of this very extenſive ſcience. I propoſe, however, to make ſome ſhort remarks, no leſs uſeful than entertaining, concerning the heads of this ſubject, leſt Botany ſhould appear to be quite tedious and barren to learners, as conſiſting ſolely in an acquaintance with names and technical words.

" The Subject, or natural Hiſtory of Herbs, or " Botany as it is commonly called, is divided in- " to two parts; the firſt of which conſiſts in the " right knowledge of plants, and the ſecond in " applying them to their moſt beneficial uſes. " Nothing more ſeems requiſite to know plants " very well, than to call them readily by the " names which are properly impoſed upon them: " for, in this art thoſe ought indeed to be choſen " which have ſome connexion with an idea of the " ſtructure of the parts, from which the diſtin- " guiſhing mark, or characteriſtic of plants a- " riſes." *

" Botany is nothing elſe but a method, by " whoſe aid plants are known the moſt advan- " tageouſly,

* *Joſephi Pitton Tournefort Inſtitutiones rei herbariæ. Pariſiis* 1700. 3 *Voll. in* 4*to. Item Lugduni* 1719. *Vid. pag.* 1.

" tageously, and with the leaſt trouble, and re-
" membered." *

" Botany is the ſcience of vegetables, or the
" knowledge of thoſe things that are tranſacted
" by plants and in plants." †

§. I.

3. " On the whole, ſays *Theophraſtus*, a plant
" is a various and manifold thing; and it is uni-
" verſally difficult to tell what it is. There is
" no abſolutely diſtinct mark, which may be rec-
" koned common to and agreeing with all plants,
" as a mouth and ſtomach are proper to animals.
" For, neither a root, nor ſtalk, nor branch, nor
" bud, nor leaf, nor flower, nor fruit, ſeems to
" belong to every plant." ‡ Hence it is, that
ſcarce an accurate definition agreeing to all plants
and thoſe alone is to be met with in authors.

4. " A Plant, as *Jungius* defines it, is a living
" but not a feeling body, fixed to a certain place
" or certain ſeat, which can be nouriſhed, grow,
" and

* *Hiſtoria Plantarum, quæ in Horto Lugduno-Batavo creſcunt; deſumpta ex ore Cl. Hermanni Boerhaave. Romæ* 1727. *in* 8vo. *Vid. p.* 16. This work is evidently unworthy of the moſt celebrated Profeſſor.

† *Ludwig. aphor.* 1. *Caroli Linnæi Philoſophia Botanica, in qua explicantur Fundamenta Botanica. Stockholmiæ* 1751. *in* 8vo.

‡ *Theophraſti Ereſii opera omnia. Lugd. Bat.* 1613. *in folio. Vid. Hiſt. Pl. l.* 1. *c.* 2.

" and laſtly propagate itſelf." * According to the moſt famous *Tournefort* †, " It is an organical " body, which is always furniſhed with roots, " perhaps always with ſeeds, and almoſt always " has leaves, flowers, and ſtems." " All that " ſubſtance which from the body whereto it ad- " heres or that ſurrounds it, ſays *Pontedera*, is ex- " plicated with the juice flowing to it into ſome " certain and determinate form, by the influence " of the air contained in its tracheæ *(or air veſſels)* " ſeems to appertain to a plant." ‡ " Vege- " tables, as *Ludwig* would have it, are named na- " tural bodies, always endued with the ſame form, " but void of loco-motion." || And laſtly with the illuſtrious *Boerhaave*, " A Plant is an hy- " draulic body, conveying different fluids in dif- " ferent veſſels, which adheres by ſome external " part to another body, whence by that part it " draws the matter of its nouriſhment and " growth." ||||

Theſe definitions however ſeem neither to include all vegetables, nor exclude all animals; ſince ſome of the latter are conſtantly fixed to another body, and ſome of the former float freely on the

* *Joannis Raii Hiſtoria Plantarum.* 3 *Voll. in folio Londini Vol.* 1. 1686. 2. 1688. 3. 1704. *Vid. pag.* 1.

† *Inſt. p.* 54.

‡ *Julii Pontederæ Anthologia, ſive de floris natura libri tres; cum Diſſertationibus xi. Patavii* 1720. *in* 4*to. Vid. Diſſert.* 1. *p.* 5.

|| *L. Phil. Bot. p.* 1.

|||| *Element. Chem. Tom.* 1. *p.* 57.

the ſurface of water. Nor will the deſcription of the moſt famous *Linnæus* ſupply their defect *, who before he had underſtood any thing by life, ſhould have explained it otherwiſe than is done in the Sponſalia Plantarum †, and have proved that all animals have ſenſation.

5. Are therefore the great kingdoms of nature to be confounded? Or are vegetables to be claſſed with animals? By no means. They agree in many things but not in all. They all grow indeed and are nouriſhed: yet, ſince animals receive the matter of their nouriſhment by pores or veſſels ſituated on their internal ſurface; but vegetables take in theirs by pores or veſſels placed on their external ſurface; this is a ſufficiently notorious and eſſential difference. A vegetable may therefore be deſcribed, to be an organical body, which draws the matter of its nouriſhment and growth by pores or veſſels placed on its external ſurface. And conſequently it may be aptly enough called *an inverted animal.*

§. II.

6. A vegetable performs two grand works, as the great *Cæſalpinus* ſpeaks ‡, which are as it were

* *Fundamenta Botanica. Amſtelodami* 1736. *in* 8*vo. Edit.* 4. *auctior. Pariſiis* 1744. *Vid.* §. 3.

† *Joh. Guſtavi Wahlbom. Sponſ. Pl. in Lin. Amæn. Acad. Vol.* 1. *p.* 64.

‡ *Andreæ Cæſalpini de Plantis libri* xvi. *Florentiæ* 1583. *Ejuſdem Appendix. Romæ* 1603. *in* 4*to. Vid. prioris l.* 1. *c.* 13.

were its natural functions, or offices: the firſt of which is the attraction of aliment, whereby it is nouriſhed and grows; and for the ſake whereof it is provided with a root and bud. But the ſecond function, or work, of a vegetable, is the generation of another like itſelf; and the parts given to it on this account are the fruit, and likewiſe the flowers, which are ſubſervient to fructification. We ſhall take a curſory view of the external and internal ſtructure of theſe parts; and afterwards of their uſe in vegetation and fructification.

7. The *Root* is the inferior part of a plant, generally concealed in the earth, deſtined for attracting aliment, compoſed for moſt part of a cuticle, bark, wood, and pith; and it is either fibrous, or tuberous, or bulbous.

But according to the moſt famous *Ray* *, roots may be divided into the *fibrous* and *thicker*. He calls thoſe *fibrous* which conſiſt only of many filaments. The *thicker* or *fleſhy* are ſuch as *ſwell much out in breadth*, or are *extended greatly in length*. The *broad fleſhy* roots are either *bulbous* or *tuberous*. The *bulbous* are either *coated*, as the Onion, or *ſcaly*, as the Lily. The *tuberous* (*knobby*) or thoſe conſtituted of continuous fleſh, have either a *ſimple* tuber (*knob*), as Turneps, or *ſeveral knobs*, as the Peony. *Long* roots are either *twiggy* and creeping, as the Liquorice, or *ſtalk-like*, as the Cock's-head vetch or Saintfoin.

8. The *Trunk* is a more remarkable part, by which trees and moſt herbs are raiſed up: its lower

* *Hiſt. Pl. p.* 3.

lower extremity is separated into spreading, or as it were jagged roots, that are fixed in the earth, and all the rest of it is divided and subdivided into branches, on which leaves, flowers, and at last seeds, hang. It has various names bestowed upon it. In trees it is called *caudex* (*the tail, or stock, or body, or stump*), *stipes* (*the stalk, or stem*), and *truncus* (*the trunk, or boll*); but in herbs (*also in fruits*) *caulis* (*the stem, or stalk*); and particularly, in the tubular kinds of them, it has obtained the appellation *calamus* (*the reed, or cane, or straw*); in the leguminous (*or all sorts of pulse*) *scapus* (*the upright pillar-like stalk, or stem*); and in all manner of corn, or grain, *culmus* (*the stem, or stalk, or straw from the root to the ear*) *. It consists of the same parts as the root; and is either single, or branched.

9. The *Leaves*, in whose abundance nature seems to be luxuriant, are principal and remarkable parts, by which trees and herbs are perfected. For, all those things which are collected in the trunk or stem, being reduced as it were into a compend, and resolved by a farther production into extreme and younger parts, are expanded into leaves, so that they seem to be the *appendices* of the elongated and disgregated trunk, serving to concoct the aliment †. A leaf is either *simple* or *compound*. A *simple* is either *plane*, with an intire and equal,

* *Marcelli Malpighii opera omnia, in duos tomos distributa, quorum prior Anatome plantarum est. Lugd. Bat.* 1687. *in* 4to. *Vid. p.* 19.

† *Ibid. p.* 53.

or a variouſly unequal margin; or *round*. A *compound* leaf is either *triangular*, or *digitated*, or *winged* *. Concerning Flowers, ſee below § x.

§. III.

10. That plants conſiſt chiefly of very ſmall tubes and veſicles, with their contained fluids, *Malpighius* long ago firſt demonſtrated. Some of theſe pipes contain humours, and others only air, which therefore always appear empty: almoſt the ſame may be ſaid of the veſicles; yet with this difference, that only the veſicles of the pith, after the firſt year, never have any juice in them. A brief account of theſe parts follows, with their uſe, from that illuſtrious author.

11. The *ligneous fibres*, which were antiently ſtyled *nerves*, *filaments*, and *pectines* (*or woody veins*), are tubular ſubſtances, pervious to entering liquors; whoſe texture conſiſts of ſquare, or orbicular, hollow bodies, opening into one another. Theſe veſſels neither run in a ſtraight nor parallel direction; for, they are generally gathered into a little bundle; and ſome of them being again bent and ſeparated, they form a net-work †. Theſe fibrous packets are made up of a great many threads; and every obſervable fibre is conſtituted of pipes communicating with each other, and pours out a fluid: But in its progreſs it is bended ſideways and united to another packet; it is then ſtretched directly upwards, and afterwards obliquely, and being

* *Raii Hiſt. Pl. p.* 13.
† *Malpig. p.* 22.

being interwoven with the neareſt little bundle, a net-work is thereby faſhioned. The greateſt ſhare of the bulk of the wood is made up of theſe threads, or pipes, running lengthways, which again are compoſed of orbiculi, or little round concave balls, or bottles, or bladders, opening into one another, diſpoſed alſo longitudinally *.

12. Among the above-explained fibrous or fiſtular packets the *ſpiral pipes* are placed, which are leſs numerous than the woody fibres, but of a bigger ſize, ſo that their open mouths may be ſeen gaping on the cut extremities of trunks. They have various ſituations; but the greateſt ſhare of them is comprehended under different circles, variouſly placed about a center, and containing each other. They are not conſtantly of the ſame external figure; yet, for moſt part, they have an oblong and tubular form, and are here and there a little ſtraitened in their diameters, ſo as to reſemble many orbiculi, or little round bottles, communicating with one another: ſometimes however, theſe utriculi, or little bottles, have different angles, and make a continued canal; and ſometimes ſmooth, tranſparent, and oval little bags, impervious at one end, like thoſe obſerved in the lungs of inſects, are found; likewiſe, frequently many orders, or rows, of veſicles ſtraitening each other, and contained as it were in the ſame woody tube, form theſe ſpiral pipes.

The deſcribed ſpiral tubes are compoſed of a thin and pellucid zone, (*reſembling a piece of rib-band, or tape*;) or as it were a very narrow lamina

* *Malpig. p.* 2.

of a silver colour, which being contorted spirally, and contiguous at the (*somewhat overlopping*) extremities of its edges, constitutes a tube that is a little rough both internally and externally. A beautiful sight is presented in some plants: while the continuity of a recent and unwithered branch, or stalk, (*as likewise the leaf and root, for example, of the Vine, both the Cornels, the Scabious, Squil,* &c.) is gradually pulled asunder, torn or broken portions of the spiral pipes, or tracheæ, remain. For, these sometimes keep up as it were a peristaltic motion for a considerable time *. If this lamina (*or membrane*) be farther viewed through a microscope, it is seen to consist of particles placed like scales on the skins of fishes; which mechanism is also found in the tracheæ of insects †.

These pipes, which he pleased sometimes to name *spiral* from their composition, but more properly *tracheæ* from their office, are found in all trunks, small stalks, leaves, flowers, and the other parts with which vegetables are completed, and they are continually open. In the ligneous portion they abound more and less plentifully, and obtain such a position, as to be perpetually surrounded and inclosed, as it were in a sheath, by a little bundle of woody fibres; and in the small stalks of some plants, collections of these tracheæ, or air-vessels, are so very artfully associated with the ligneous fibres, as necessarily to be a mystery of nature ‡. In plants and insects nature has so ingeniously framed the spiral lamina, which is fabricated

* *Malpig. p.* 3.
† *Id. p.* 26.
‡ *Id. p.* 31.

bricated of ſmall ſcales, that it may ſuffer contraction and dilatation in the violent flexions and curvatures of trees, and from the elaſtic motion of the confined air. The thus conſtituted tracheæ of plants, without declining much from a ſtraight courſe, are diſperſed from the roots upwards into the trunk, ſtalk, and branches; but in the leaves they have a crooked diſtribution and are wrought into a net-work *. In the bark no tracheæ have been yet diſcovered; nor, ſo far as I know, in the ſeed.

13. The intermediate ſpaces in the net-work of the fibrous pipes are filled with *utriculi*, or roundiſh *little bags*; beſides, a whole packet of fibres is here and there encompaſſed with them, and they have for moſt part an horizontal direction: For, the tranſverſe orders of them, proceeding from the bark, and being produced through the ligneous fibres, empty themſelves internally into the pith, whence they are both found to be of the ſame nature. But their form and magnitude are various; for, by preſſing one another, where they are copiouſly crowded, they gain a different configuration, as oval, oblong, and angular, that they may be adapted the more eaſily to each other; and their colour too is various. They are compoſed of a ſmooth diaphanous membrane, and inoſculate with one another †.

14. In the fabrick of herbs and trees, beſides the air-veſſels and the ſucciferous tubes, we find *a peculiar*

* *Malpig. p.* 32.

† *Id. p.* 2. 24. 30. &c.

peculiar ſmall veſſel, full of turpentine, gum, and ſometimes of a concreted and proper juice, or humour: we can only admire the progreſs of this ſort of veſſels in thoſe plants whoſe juice by concreting acquires ſolidity, or is tinged with different colours. But it ſeems very probable to our famous author, that in every plant there is a particular veſſel which conveys its ultimate and ſpecific nouriſhment. So that how many ſoever ſpecies of plants exiſt, ſo many peculiar juices may be found *.

15. Hence, trees are nothing elſe but ſmall ſeparate pipes produced, or elongated, through the earth, which are gradually collected into little bundles; and theſe packets being farther conjoined to others more remarkable, at length all of them being gathered for moſt part into one cylinder, form the trunk; whoſe oppoſite extremity, by making alſo a ſeparation of its tubes, ſends forth arms or branches, and by degrees the greater branches are ſubdivided into leſs, till the extenſion is at laſt made into leaves, in which it ultimately terminates. The extreme roots therefore conſiſt of one or two tracheæ, or air-veſſels, about which tubular ligneous plexuſes play, which are ſo reticularly diſpoſed, as that the intercepted areæ are acutely angular; but as the root increaſes in thickneſs, by other ſmall roots being united to it, tranſparent woody fibres, like hairs, fill the interſtices

* *Malpig. p.* 34. See *The Anatomy of Plants, with an idea of a philoſophical hiſtory of them. By Nehemiah Grew. London* 1682. *in folio.*

interſtices of the tracheæ, and are invironed with a thick and ſoft bark *.

§ IV.

16. The bark of trees, beſides the concoction of nouriſhment, ſeems to have a peculiar office aſſigned it, and that is, to cauſe their increaſing growth or thickneſs; as happens every year from the addition of a new covering, or layer, of fibres, which being intermixed with horizontal rows of utriculi, and gradually acquiring an hardneſs, at laſt obtain the real conſiſtence of wood. In the *liber*, or *inner bark*, nature always produces new orders of fibres, or at leaſt manifeſts by the augmentation, what parts ſhe obliges habitually to convey aliment, by the ſoftneſs of them admitting it, which, at length being become firm, ſhe applies to the contiguous parts of the wood whereto they adhere, and ſo a new augmentation or increaſed thickneſs of the trunk and branches is occaſioned by a zone, or ring of wood being brought upon them.

17. Whence, we may juſtly infer, that the principal part of trees is that portion of the bark which is joined to the wood, by whoſe aſſiſtance plants perpetuate life, trunks become thicker and thicker, and their germination or budding, as well as fruitfulneſs ſucceed. Wherefore, the exterior portion of the bark, which is very much decayed by the injuries of the air and tranſpiration, and rendered lifeleſs and rigid, is added for a ſafeguard to the *liber*,

* *Malpig. p.* 11.

liber, or *inner bark*, which alſo does not a little defend more interiorly the ſubjacent wood. Hence it is probable, that ſuch plants as have annual ſtems, or which at leaſt do not laſt a long time, and have no ligneous portion joined to the cylinder, are deprived by nature of a bark, and are only furniſhed with a cuticle, or ſmall bundles of fibres; but in the reſt, whoſe augmentation is required for a very conſiderable time, in the bark, like as in the firſt delineation of the ſtamina or rudiments, orders of ligneous fibres are prepared, and depoſited in the *liber*, or *inner bark*, that they may ſhew themſelves more increaſed, and emerge at a ſtated time *.

18. From the difference of *roots* and *buds*, the moſt famous *Cæſalpinus* † aptly enough and uſefully determines, that the primary or higheſt genera of plants ought to be conſtituted, and divides them into *trees* and *herbs*; with the conſent of all Botaniſts that have either attempted to give a general hiſtory, or method of plants, before the great *Carolus Linnæus*; who, having rejected this diviſion as unnatural, every where confounds herbs with trees.

" *Gems*, (or *buds*), (*he ſays*) are really *winter-*
" *quarters*, ſince they preſerve the tender plant
" through the winter from the ſeverity of the
" weather. Hence it is, that the great Creator
" hath allotted gems to moſt trees growing in
" cold countries: but on the contrary has for moſt
" part

* *Malpig. p.* 23. & 24.
† *Lib.* 1. *c.* 13.

" part refuſed them to the trees of warm regions. " The *Citrus*, *Jatropha*, *Pereskia*, *Aſclepias*, *Ala-* " *terms*, *Gerania*, *Lavatera*, *Frangula*, *Ruta*, &c. " are deſtitute of gems *." Whether all theſe are properly called trees; or ſuch as may be propagated by inoculation, are deſtitute of eyes, (or gems), let others judge. But he adds, " And " therefore *Ray*'s and *Pontedera*'s diviſion of plants " into herbs and trees, founded on gems, is of no " force, ſince they ſhould have known that it " would be abſurd to take the ſame diſtinction " from the duration of the ſtem." Yet he talks a little differently in his Botanical Philoſophy †. " For, *Plants*, (he ſays) are named *herbaceous*, " which periſh yearly above the root; *Shrubs*, " when the trunk aſcends above the earth with- " out gems; and *Trees*, when the trunk aſcends " above the ground with gems. Gems either " diſtinguiſh ſhrubs from a tree, or we can have " no limits of difference, ſince magnitude is of no " moment. *And*, Indian trees will be called the " largeſt ſhrubs, becauſe they rarely produce " gems: and therefore this diviſion is not natu- " ral, ſince betwixt a ſhrub and a tree, only the " vulgar opinion, and not nature, hath ſet any " bounds." He therefore ſeems to admit as natural the diſtinction of plants into *herbs* and *trees*. Which however, whether it is natural, or no, is of little ſignification, ſince it is extremely uſeful

* *C. Linnæi Amœnitates Academicæ. Vol. 1. Lugd. Bat.* 1749. *Vol.* 2. *Amſtelodami* 1752. *in* 8*vo. Vid. Vol.* 2. *p.* 188.

† *Pag.* 37.

in the arrangement of plants. But between ſhrubs and trees, as they are deſcribed by the moſt famous *Linnæus*, nature herſelf ſeems to have fixed notable enough limitations in the barks. For, all trees, whether they do, or do not bear gems, are endued with a true bark, and with a *liber*, or *inner bark*, which is the principal part of them: Such plants, conſequently, whoſe ſtems are not annual, but endure for ſome years, and are not covered with a true bark, but only with a cuticle, may be ſtyled ſhrubs, or numbered with herbs.

§ V.

19. Now, the nutritious humour entering by the pores of the root, or the open mouths of its veſſels, mounts upwards, and part of it at leaſt is ſuſpended: But, by what means, cannot be inſtantly told.

Since every portion, ſays *Malpighius*, which unites the ſmall pieces of the fibres to each other, interiorly projects a little, it ſupplies the place of a little valve, ſo that every leaſt drop of fluid, as if it moved by a cord, or by degrees, is raiſed to a conſiderable height. And not only do the roughneſs and *ſmallneſs* of the tubes promote its aſcent, but alſo the ſucceſſive changes, *viz.* from warm to cold, in the various conditions of day and night, of the temperature of the air; and its elaſtic movement, which urges the exterior coverings of the bark, may forward and aſſiſt the motion of the contained liquors in their aſcending courſe. Likewiſe, by the dilatation of the tracheæ, from the air within them making them turgid, the interpoſed

poſed ligneous fibres and the horizontal appendices of the utriculi are neceſſarily ſqueezed, whereby probably their contained juice is expreſſed into the contiguous parts: but when the ſwelled air-veſſels collapſe, the utriculi and ligneous pipes are relaxed, and more eaſily admit the entrance of new liquid. The aſcending humour therefore is poured, like *chyle*, into the tranſverſe utriculi; and making a pretty long ſtay in them, and being intimately blended and fermented with the older juice, it is exalted into the nature of aliment. For, it is very likely, that plants, by the active aſſiſtance of the air, are protruded upwards in germination, preſerved in a growing ſtate, and maintained in progreſſive life, that the riſe and fermentation of their juices are by the ſame means facilitated, and many other effects produced *. But theſe pehaps are more owing to the humours, &c. derived from the atmoſphere, than to the elaſticity of the air.

20. For, neither the obſerved aſcent of liquors in capillary tubes, ſponges, &c. nor the attraction of the leaves, remove the difficulty. Becauſe the woody tubes are not conical, but cylindrical; the expanſion of the leaves is cauſed by the riſe of the ſap; and, both the *Maples*, the *Birch Tree*, the *Horn-beam* or *Hard-beam Tree*, the *Wallnut Tree*, the *Willow*, and the *Vine*, bleed in the autumn, in winter, or only in the ſpring, while trees are deſpoiled of their leaves: yea, in plants which carry no leaves, as in the *upright Torch-Thiſtles*, the ſap aſcends to a great height, and that plentifully.

* *p.* 22. 23. 33. 14.

But we ſhall leave theſe things to be inveſtigated by more ſagacious mechanics, and proceed to conſider a queſtion of greater importance which here occurs.

§ VI.

21. Of what nature is that humour, or juice, with which plants are nouriſhed? Does water alone ſuffice for this purpoſe, or no? And, What is the cauſe of the various fertility of ſoils? The learned do not agree concerning theſe matters.

About ſix hundred years before the nativity of Chriſt, *Thales* the *Mileſian*, one of the ſeven wiſe men of *Greece*, to whom it is reported the other ſix having firſt conſented, ſaid, water was the original of all things, and that all things conſiſt of it; but that *God* was the mind which formed all things out of water *: The laſt obſervation he perhaps took from the firſt book of *Moſes*. That vegetables are nouriſhed by water alone there are not wanting ſome who endeavour to demonſtrate by experiments; among which is that extraordinary one of the willow of *Helmont*, by many authors oftner quoted than accurately related. His words in Engliſh are theſe:

"That all vegetables immediately and materially come forth from the ſole *element of water* I learnt by this trial. For, I took an earthen veſſel, wherein I put of earth dried in an oven two

* *Cicero De Nat. Deorum, l.* 1. & *Acad. Queſt. l.* 4.

" two hundred pounds, which I moiſtened with " rain water, and planted in it the trunk of a " willow weighing five pounds. And at length, " when five years were expired, the tree which " grew therein, weighed one hundred and ſixty " nine pounds, and about three ounces. The " earthen veſſel was large, placed in the ground, " and watered with rain water only, or always " with deſtilled water, when there was occaſion; " and, leſt any flying duſt ſhould be mixed with " the earth contained in it, I covered the top of " the veſſel with an iron plate ſoldered over with " tin and made full of holes. I did not compute " the weight of the leaves that fell off in the four " autumns. At laſt I again dried the earth in the " veſſel, and found only about two ounces want- " ing of the two hundred pounds. Therefore one " hundred and ſixty four pounds of wood, barks, " and roots, had ſprung from water alone." Thus *Helmont* *.

The illuſtrious *Boyle* likewiſe took the trouble to ſow, in ſome earth dried in an oven, a ſeed of a certain Indian pumpion, or melon, which, in the ſpace of five months, grew up into a plant weighing four pounds and three quarters; and found that the earth when dried again had loſt nothing of its former weight.

" Nor are the experiments of the moſt illuſtri- " ous *Boyle* (ſays Mr. *Geoffroy*) of leſs moment than " that of *Helmont*, which has been often repeated " by others, and they are far more accurate. He " put ſprigs of Mint, Marjoram, Pennyroyal, and " Balm, into bottles filled with limpid water, *and*

" *the*

* *Com. pl. Elem. figm.* § 30.

" *the ſprigs of three drachms or half an ounce in*
" *weight, increaſed to ſix ounces and upwards*;
" which being afterwards deſtilled did not afford
" a leſs quantity of principles, than branches of
" plants which were planted in a fat earth *."

22. It is alſo very well known to perſons skilled in agriculture, how much breaking the earth into ſmall parts, forming it into heaps, expoſing it long to the ſun and open air, ſheltering it with hedges of living plants, &c. conduce to its fruitfulneſs, without any manure: *It is likewiſe often advantageous to burn barren fields.* I made various experiments, with ſal ammoniac, ſea-ſalt, nitre, quick-lime, &c. in order to diſcover what they contribute to the fertility of ſoils; and briefly,

I found, (1) That one part of any of the above mentioned ſalts, diſſolved in ſomewhat more than ninety parts of common water, killed mint planted in it: the ſolution of ſal ammoniac indeed deſtroyed it in the ſpace of one night; that of nitre in a week; but that of the marine ſalt much later, *viz.* the part of the mint under water, for that part of it which was above the water, withered in the ſame time as in the ſolution of nitre. (2) That ſmall and lean earth, as being very ſandy, and taken out of earthen pots in which ſhrubs had grown for ſome years, and only ſifted, nouriſhes plants as well, and ſeeds come up in it as vigorouſly, as in the fatteſt earth, and are leſs infeſted with inſects. (3) That the ſame lean earth, mixed

* *Geoff. Mat. Med. Vol.* 1. *p.* 9. See *Boyle's Works, Vol.* 1. *p.* 312. &c. and *Vol.* 2. *p.* 498.

mixed with a thirty ſixth part of calx vive, kept dry for a year, made it worſe, and leſs fertile, by almoſt a third part. For, a plant ſet in it, at the end of ſeventy four days, weighed ſix drachms and fifty grains; while the weight of another plant, of the ſame kind and equal ſize, which grew in the lean earth without quick-lime, in the ſame ſpace of time, amounted to nine drachms and twenty four grains. (4) That lime-water does not corrupt bulbs of the Hyacinth and Tulip, though macerated in it for many days: but that the root of the Oriental Hyacinth with a blue flower, put into a glaſs of this water, immediately languiſhes; neither its leaves nor ſtalk attain their uſual length, its flowers turn red, and are not fully expanded; and the fibres which it had before ſent out are ſoon conſumed. And (5) That ſhrubs and herbs kept in earthen pots, and watered for many months with this lime-water, neither grow more vigorouſly nor more languidly, as far as I could obſerve.

And therefore I am forced to conclude, that we cannot eaſily arrive at the knowledge of the preciſe nature of the humour ſtrained from the earth, for the ſucceſsful advancement of vegetation, if it be different from water. For, the fertility of ſoils is more promoted by *aphaireſis*, than *proſtheſis*; viz. by ſubtracting or removing thoſe things that hinder it, ſuch as too much moiſture or dryneſs, ſolidity or lightneſs, hardneſs, toughneſs, ſourneſs, coldneſs, inſects, hurtful weeds, &c. than by adding thoſe things which are defective; or what water and air, aſſiſted by heat, cannot ſupply.

§. VII.

§. VII.

23. There was publiſhed at *Leyden* in 1743, in 4*to*. *A Diſſertation*, in which the phyſical queſtion, *What is the cauſe of the fertility of ſoils?* propoſed by the *French Academy* at *Bourdeaux* in 1739, is treated of by *John Adam Külbel*, M. D. and by it he obtained the appointed reward of a golden medal. But it ſeems to be ſupported by hypotheſes, and not ſufficiently by ſure experiments. For, in Theſis 8. he thus argues, "Since "the ſubſtance of vegetables not only conſiſts of "fluid, but likewiſe of ſolid or terreſtrial parts, "it thence follows, that the nutritious juice of "vegetables ought to be compoſed alſo of terreſ- "trial parts, which the earth yields it out of its "boſom." But he himſelf below acknowledges, in Theſ. 39. that theſe terrene parts may be derived from water: For, he ſays, "By examining "the matter more thoroughly, it will be found, "that water wholly furniſhes out of its lap, the "ſolid particles neceſſary to increaſe the ſubſtance "of vegetables."

24. Then, in Theſ. 10. "Since the terrene "portion of the nutritious juice, *he ſays*, muſt be "very ſubtile, and eſpecially diſſolvable in wa- "ter, and the earth furniſhes it out of its boſom, "it hence may be inferred, that *that peculiar diſ- "poſition of the earth*, by which one field is uſu- "ally more fruitful than another, conſiſts in this, "that the more fertile abounds with greater "plenty of that ſubtile earth, which is ſoluble in "water; but the more barren field contains very "little,

" little, or none at all of it, unleſs it be artificial-
" ly ſupplied with it by dungings." To confirm this allegation he recites an experiment, on which his whole opinion, or the ſolution of his queſtion, depends; which is thus propounded, in Theſ. 11. 13. 14.

" To prove, *he ſays*, the truth of the aſſertion,
" I took earth that was vaſtly fertile and without
" ordure, and poured hot water on *a portion* of it;
" the lixivium I filtered through blotting paper
" and reſerved it. I again extracted with more
" hot water what I could from the remaining
" earth, nay, I boiled it a little; the extract I
" filtrated and mixed with the former. I repeated
" ſeveral times this extraction of the ſame earth,
" and at length I ſo concentrated all the extracts
" in glaſs platters, by gentle evaporation, that of
" *ſome meaſures* of them, only one pound did re-
" main. The concentrated extract was of a dark
" brown colour, and had let fall during the eva-
" poration much of *a ſubtile and unctuous earth*,
" found on the ſides and bottoms of the glaſſes;
" and the ſurface was covered with a kind of cu-
" ticle, ſuch as ſaline lixives commonly form while
" they are evaporating. If it be gently evaporated
" to dryneſs, *an unctuous ſaline magma* is obtained, of
" a browniſh red colour; but if it be again diſſolved
" in water, filtrated, and gently evaporated, it be-
" comes pellucid, and acquires a more elegant co-
" lour, and depoſites no longer any thing terreſtrial,
" how often ſoever it be ſtill diſſolved. The ſame
" experiment ſucceeds with all fertile earths, ſo
" that by how much the more fertile any earth is,
" it ſupplies water with ſo much the more of the ſub-
" tile ſubſtance: Yet it does not ſucceed ſo readily

" with the intirely muddy, clayie, ſandy, and " other barren earths, becauſe they communicate " very little, or ſometimes abſolutely nothing, to " a watery menſtruum. Hence it follows, that " the ſpecific difference in the nature of fertile " and barren earths conſiſts in this, that thoſe con- " tain much, and theſe but little or none, of a ſub- " tile terreſtrious ſubſtance which is ſoluble in " water." Thus Dr. *Kylbel*. But the oration ſeems to be lame.

25. For, (1) The quantities of the fertile earth, and of the water which the learned *Author* uſed, as alſo of the unctuous ſaline magma, are wrongly omitted to be mentioned; for, what *a portion of fertile earth, and ſome meaſures of water* denote, I cannot imagine. But beſides, (2) He did not try, whether " grain and corn would grow more vi- " gorouſly and more plentifully in his unctuous ſa- " line magma," by itſelf, or mixed with ſand, than in any other earth, or than in the earth re- maining after (his firſt at leaſt) extraction. For, an eminent writer on husbandry, *Jethro Tull*, re- marks, " That nitre and other ſalts, afford no bet- " ter nouriſhment to plants, than arſenic does to " mice." If indeed either of thoſe things had happened, it would have been needleſs to have proſecuted any farther his inquiries.

I took of earth, fertile both by art and nature, eight pounds, four pounds of which I diluted with more than four times the quantity of water, I ſtir- red it ſtrongly and for a long time with a ſtick, and after a maceration of five days, I poured off the water, and moderately dried the earth. In this waſhed earth, I planted nine ſeeds of the com-

mon

mon cucumber, and as many of the garden radiſh; and at the ſame time, I ſowed an equal number of the ſame ſeeds in the other four pounds of the ſame earth unwaſhed, but ſufficiently wetted. Yet they did not grow in the leaſt more vigorouſly or more copiouſly in this than in the other: nay, on the contrary, they vegetated more vigorouſly and plentifully in the waſhed than unwaſhed earth, eſpecially the ſeeds of the cucumber. It will perhaps be objected by ſome, that all the ſubtile and unctuous earth cannot be extracted by cold water, but by boiling, and repeated affuſions of it. But what can be only thus extracted from earth, will certainly never be extracted by the roots of plants, or conſtitute a part of the nutritious juice. The aſſertion therefore of our author, with ſubmiſſion to the illuſtrious Academy, and the celebrated *Carolus Linnæus* *, is not at all proved by this experiment, nor can it be proved by any means as far as yet appears. Conſequently we need not be ſolicitous about the analyſis of this magma, howſoever imperfectly it is delivered.

26. Laſtly, in Theſ. 34. it is thus written, "Yea, this unctuous earth owes its original production to the vegetable kingdom.——Yet, it "is from thence manifeſt, that it was naturally "bred in the earth from the beginning of the "creation, becauſe there are fields in their own "nature ſo fruitful, that they evidently want "no aſſiſtances from dungs." Which indeed ſeems plainly to contradict the hypotheſis of our famous author. That there are ſuch fields, is not

* *Phil. Bot. p.* 88.

to be denied: but we are not hence to conclude they are therefore fertile, becauſe they abound with that unctuous earth; for, though they only conſiſted of ſuch an earth, this would in time be neceſſarily conſumed: and ſuch fields are rather to be reckoned fruitful, becauſe no impediment to vegetation exiſts in them, and they require to fertility, only the aſſiſtance of water, air, and heat, as is confirmed by the above-mentioned (No. 22.) experiments.

§. VIII.

27. We meet with a ſtill more recent, and more obſcure account of vegetation, in the *Hiſtoire Phyſique*, lately and firſt printed at *Paris*, and afterwards reprinted at the *Hague* in 1750. in *4to.* which, if I underſtand the author, is to this purpoſe *:

Since ſalts and ſome other foſſils are compoſed of parts, both exactly like their own, and thoſe of the body which they conſtitute; a grain of ſea ſalt being a cube, conſiſting of infinite other cubes; plants which have a power to produce others like themſelves, from all parts of theſe things, are organical bodies, compoſed of other exactly ſimilar organical bodies, whoſe primitive and conſtituent parts are likewiſe organical, not indeed perceptible to the eye, but by reaſon and analogy; hence we are induced to believe, that *in nature* really *exiſt an infinity of organical living parts, of the ſame ſubſtance with the bodies which they conſtitute.* For, as perhaps thouſands of thouſands, of ſmall ſaline

* *Tom* 2. *c.* 2. *p.* 8.

ſaline cubes, are to be accumulated, to form one ſenſible grain of ſea-ſalt; ſo thouſands of thouſands of organical parts, exactly ſimilar to the whole, are required, to form even one of the buds which one individual elm contains.

" To me therefore, *he ſays*, it appears very " likely, that there actually exiſts *in nature an* " *infinity* of ſmall *organical beings*, quite ſimilar " to the great organical beings conſpicuous in the " world; that thoſe ſmall organical exiſtences *are* " *compoſed of living organical parts*, common both " to animals and vegetables; that theſe organical " parts are *primitive* and *incorruptible*; that col- " lections of theſe parts form viſible organical " exiſtences; and conſequently, that *reproduction*, " or generation, is only the change of form, which " happens and is brought about by the ſole addi- " tion of perfectly ſimilar parts; as alſo *the de-* " *ſtruction* of an organical being, proceeds from " their ſeparation." An opinion indeed ambiguous from a tedious and intricate detail of words, if different from that of the ſchools, concerning the materia prima and ſubſtantial forms.

28. For, 1*ſt*, It ſeems difficult to tell what he means by *organical parts*. Becauſe they are all, either always of the ſame determinate figure, or conſtitute equally well an elm, or a cabbage; and then they differ in no reſpect from the atoms of the Epicureans, and a knife will conſiſt of organical parts: or, the figure of thoſe in the elm, differs from that which they have in the cabbage; but if ſo, an elm could not be nouriſhed by a cabbage, howſoever putrified, which is not true.

2*dly*,

2*dly*, He calls theſe organical parts *incorruptible*: and in one ſenſe all matter may perhaps be ſaid to be incorruptible; but then there would be no diſtinction between organical and non-organical parts, or betwixt organical bodies, and rude (*corps bruts*) or non-organical bodies. However, either all the parts of vegetables are organical and incorruptible, or only ſome of them. If all are ſo, then all the parts of water are alſo organical and incorruptible; ſince by far the greateſt ſhare of vegetables is the mere element of water. If only ſome of the parts of vegetables are organical and incorruptible; theſe muſt neceſſarily be a chemical earth, or water; ſince all vegetables and their conſtituent parts, can be reſolved by art into water and earth. And if the parts of water and a chemical earth are organical, there is no matter, or body, whoſe parts are not organical.

3*dly*, It is alſo expedient, that theſe organical parts be *living*. I ſhall not here explain in how many different ſenſes the word *life* is taken. Our author however, unleſs I am miſtaken, means by it the power, or faculty, of ſpontaneous motion. But how any part of matter can move itſelf ſpontaneouſly, unleſs it be likewiſe endued with an elective power, or will, I do not ſee. For, ſince of itſelf it equally tends upwards and downwards, to the right hand and to the left; at leaſt no reaſon can be aſſigned, why ſuch a particle of itſelf will move in one direction, rather than in any other: therefore, unleſs it be determined by ſome other cauſe, or can determine itſelf, it will never move out of its place. Beſides, ſince theſe parts are *exactly alike*, *and of the ſame ſubſtance*, if one of

of them be ſuppoſed from its own nature to move upwards, they will likewiſe all move themſelves upwards; and ſo never conſtitute an organical body. For, ſince to form even one bud of an elm, thouſands of thouſands of ſuch organical parts are required, by no means does their conjunction ſuffice, nor their ſimple coheſion, by what power ſoever it be accompliſhed; but they ſhould be diſpoſed only in one, certain and definite order, of the infinite poſſible orders, that thereby the various veſſels, &c. may be formed, and placed in that wonderful manner, as is obſerved in ſuch a bud. To effect which, evidently another energy and deſign, yea more than human reaſon, is requiſite, which the author I ſcarce expect will find in his organical parts, though he ſhould feign that they both feel and think.

29. Nor will his feigned internal modes, or interior forms *, though they did exiſt, extricate him out of his labyrinth, unleſs he would alſo give them a directing, applying, and conjoining power, as well as exterior modes keeping theſe organical parts in order; and of all of them more than an infinite variety. I have called them feigned forms, becauſe I am entirely ignorant to what kind of beings they belong, ſince they are to be named neither ſpiritual, nor material. The analogy alſo of ſuch modes, with gravity, ſeems to be very far fetched. For, let *gravity* be a quality in nature, or an exceedingly active power, and intimately pervading the ſmalleſt particles of bodies; which, however, is difficultly proved; ſince

* *Modes interieurs, l. 5. p. 131.*

ſince it is not leſs philoſophical to affirm, that thoſe things are performed by impulſe, which are aſcribed to gravity, than by attraction *. However, if it be a quality, it is inherent in every particle of matter, and its force is every where uniform. But, the ſuppoſed modes are neither inherent in all matter, nor in any ſimple organical part, nor in the great organical bodies themſelves, nor is their influence uniform; and if they are modes of ſubſtance, they ſubſiſt without ſubſtance, or may ſubſiſt.

30. And, 4*thly* and *laſtly*, Theſe organical parts ought to be *primitive*; that is, unleſs I am deceived, produced at the beginning; *viz.* at that time, when *a comet* being rapidly projected towards *the ſun*, ſhook off from its body thoſe ſmall particles, of which the earth was formed, together with the other planets, and their ſatellites; to all which, by the force of percuſſion and inherent gravity, it communicated the motion and order, which they retain to this very day. At that memorable time, I ſay, when from the ſubſtance of the ſun, liquified by the moſt intenſe and wave-like heat, the ſea was produced, or ſo great a collection of waters covering the earth, that the tops of the higheſt mountains did not ſtand up above it, till after, I know not how many, ages of ages †.

That birth-day of the world will now never be forgotten; nor can the ſhoals of fiſhes that inhabit the ſea, be robbed of that dignity derived from their anceſtors, which is peculiar to them above

* *Vid. Neut. opt. p.* 351.

† *Vid. Hiſt. Phyſ. tom.* I. *p.* 47. &c.

above other animals, ſo long as they continue its lords: till, to wit, by the ſpontaneous motion of the waters, and fortuitous blaſts of winds, by little and little, clots, and then heaps of earth, hillocks, hills, and mountains, a very long time after, are piled up in the abyſs; and at length the earth appears dry; and ſo on. [See what is ſaid of the calmneſs of the waters at the bottom of the ſea, in the works of the moſt famous *Boyle*, Vol. 3. p. 112.] For, it is ſufficiently evident from the ſmall alteration which the earth has undergone, in the three or four thouſand years laſt paſt, that myriads of years are required to produce ſhell-fiſh, whoſe ſhells are found on the ridges of mountains, as well as in the gravel-pits of valleys.

31. Yet, theſe perhaps are not the ſpoils of ſea animals, but were created in the beginning at the ſame time with other terreſtrial things; or were more recently produced, as many minerals are, for inſtance, figured ſtones, as it were by vegetation, (or cryſtalliſation). "What ſhall we ſay to the "obſervation of the moſt learned *Camerarius*, who "relates, that in the *Dutchy of Wurtemberg* were "dug up more than ſixty jaw-bones, ſome of which "were larger than thoſe of camels, and others were "thought to have belonged to elephants; that "the forms of all the bones, from the leaſt by a "gradation to the greateſt, were exactly the "ſame; and that though many of them could not "be diſtinctly ſeen but through microſcopes, yet "theſe were furniſhed with their apophyſes, or "proceſſes *?" Whence comes theſe, and other

* *Vid. B. S. Albin. orat. inaug. p.* 40.

petrified bodies, called animals? Whence is it that vipers are to be found in a rock in the island *Melita*? Why are all these wreathed in the same manner, and with their heads seemingly cut off? Perhaps these, as also innumerable lapideous plants, to be met with almost every where, are of the same age with the shells of shell-fish: and, if it be so, the singular hypothesis of our author will be overthrown, or, in other words, without a support.

32. "A certain heterodox divine, *he says*, whose "head was very much heated with poetical visions "or dreams, believed that he had seen the cre- "ation of the world, &c.*" And certainly nothing can be so absurdly said, that is not said by one or another of the philosophers. But the most violently heated head, among the poets, never invented a more absurd fiction, than that of our Catholic philosopher concerning the origin of the world, without creation, or rather by a mechanical or fortuitous production of the planets; as if it was unworthy of natural philosophy, to admit any supernatural cause, or to have recourse to the first cause, when, in any way soever, all second causes are wanting. That philosopher thought far otherwise, who, in treating of the world, speaks thus: "It remains that we discourse briefly concerning "the continual cause of all things: for, it would "be absurd and wicked to treat of the world, and "silently overlook what is most excellent in it. "It is therefore an old saying, transmitted by our "fore-fathers to all men, that all things were ap- "pointed from, and made by, God. For, there "is

* *Vid. Tom. I. p. 24.*

" is no nature which is ſufficient of itſelf to pre-
" ſerve itſelf without him, who is the *creator*
" and *preſerver* of all things in the world, and
" who compleatly forms all things without diffi-
" culty, and by ſimple motion. In ſhort, what
" a pilot is in a ſhip; what a charioteer is in a
" a chariot; what a precentor is in a chorus;
" what, laſtly, a law is in a ſtate, and a general
" is in an army, that God is in the world; who
" finiſhes all things without labour, without trou-
" ble, or bodily infirmity, &c.*" But to return from this digreſſion.

§ IX.

33. That the nouriſhing juice is derived from the root in a progreſſively direct or ſtraight motion to the tops of the talleſt trees, is ſufficiently clear; nor do many experiments permit us to doubt of its return or regreſs, and lateral motion. But, whether it both aſcends and deſcends by the ſame, or by different veſſels, or whether there is a circulation of the humours in plants, is not equally certain. However, by mixture, digeſtion, motion, perſpiration, or ſome other unknown property of the organs, the non-natural juice is concocted into the nature of every vegetable, or rendered natural.

But, concerning the formation or production of gems or buds, I am of the ſame opinion as *Malpighius* entertains concerning the little ſeminal plant; *viz.* that their generation is to be deemed one of the ſecrets of nature. For, as far as I could yet collect from obſervations, the embryo in a gem,

* *Vid. Ariſtot. de mundo, c.* 6.

viewed with a microſcope, no otherwiſe than in a ſeed, at the firſt inſpection appears in the form of a thin membrane, or pellicle, turgid with an aqueous humour; from this, utriculi and at length fiſtulous fibres are formed, which by vegetating are indeed ſcarce at all or little increaſed in thickneſs, but much in number and length. And almoſt the ſame thing may be ſaid of the annual coat, or increaſe of trees. For, the liber or inner bark in the ſpring time abounds with juice, from which firſt veſicles, then pipes, and at length a new liber or internal bark ariſes, when the interior part of the former applies itſelf to the wood, and is hardened in time into a new woody covering. From this new coat, as it were from a proper matrix or womb, the gems of the following year, at leaſt in our own country, come forth; and by no means from the pith of the tree, as ſome would have it.

§ X.

34. The ſecond great *work of a vegetable* is, to generate another like itſelf; which is principally performed *by fructification*; whoſe parts are the *Calyx* (or Flower-Cup), the *Petalum* (or Flower-Leaf), the *Stamen* (or Chive, or Thrum), and the *Piſtillum* (or *Peſtil*).

35. The *calyx*, or *flower-cup*, is the baſis and prop or ſupport of the flower, and by the faſhion of its body cheriſhes and infolds the beginning riſe of the leaves and ſtamina, and alſo for moſt part covers over their progreſs; wherefore it is endued with a various or manifold form and magnitude.

nitude *. " The calyx ſhould be termed the " poſterior part of the flower, diſtinguiſhed from " the foot-ſtalk by a certain remarkable thickneſs, " either involving, or ſuſtaining the flower-leaves, " or ſerving both theſe purpoſes. But, ſince it is " often a great knot, and thoſe flowers that have " a calyx, ſhould be differenced from thoſe that " want it; therefore, the leaves of flowers, of " whatſoever colour they are, ſhould be eſteemed " the calyx, when they become the proper invo- " lucrum (or covering, or receptacle) of the ſeed, " but are to be reckoned petala when this does not " happen, whether they die ſoon, or continue.†"

But, according to the moſt famous *Linnæus*, in his Fundamenta Botanica (§ 86. a.), there are *ſeven* ſpecies of the Calyx: *viz. Perianthium, Involucrum, Spatha, Gluma, Amentum, Calyptra, Volva.* And his Genera Plantarum ‡ (in the edition of 1742) contains 1021 kinds. Of theſe kinds (ſ. i. c.) 673 have for a calyx *a Perianthium*, 72 *a Spatha*, 65 *an Involucrum*, 29 *Gluma*, 18 *Amentum*, 3 *Calyptra*, none *Volva*. In his Phil. Botanica, *p.* 52. the Volva is deſcribed, " to be the membranous " cup of *a muſhroom*, ragged or torn on every " ſide." But, in 11 characters of the genera of fungi, there is no mention made of the Volva. And about 110 genera want a calyx; while ſome (about 25) have both a Perianthium and an Involucrum; others a Perianthium and Spatha, &c.

Beſides,

* *Malpig. p.* 56.

† *Tournefort. Inſt. p.* 71. 72.

‡ *C. Linnæi Genera Plantarum, eorumque Characteres naturales. Lugd. Bat.* 1737. *Editio ſecunda aucta et emendata. ibid.* 1742. *in* 8*vo.*

Beſides, the calyx of the *Coſtus* is a ſimple ſpadix, or ſimple ſpathæ, or a perianthium with three teeth: the flower-cup of the *Xyris*, *Cyperus*, *Scirpus*, *Eriophorus* is a ſpica, or ear: the calyx of 44 *umbelliferous* genera is an umbrella, &c. Of the *Moriuda* and *Eryngium*, a receptacle: Of 85 genera of *ſyngeneſious* plants, it is a common, or univerſal, or compound calyx: The calyx of the *Platanus* conſiſts only of ſome very ſmall lappets, or jags; that of the *Trichomanes* is copped, or broad above and ſmall below; that of the *Anthoceros*, *Blaſia*, *Lemna*, conſiſts of one leaf; that of the *Chara* of two very ſmall leaves; the whole margin of that of the *Fuchſia* ſurrounds (the lower half of the piſtillum, which he calls) the germen; and ſo on. There are therefore many more ſpecies of calyces than ſeven. Yet, in the mean time I do not ſee what uſe ſuch minutiæ, or little niceties, is of; ſince ſcarce any one can know in any other way what is meant by the ſpecies of a calyx, or a pericarpium, or a receptacle, than by looking at and examining the plants themſelves; and by this means he will eaſily acquire a ſufficiently clear and diſtinct idea of every calyx, &c. though he ſhould have never heard of the above-mentioned ſorts of it.

36. The *petala*, or *flower-leaves*, are thoſe leaves which for moſt part excel the other parts of the flower in ſhape, or beauty and colour, and which never become the proper ſeed-veſſel, or involucrum of the ſeed. *Fabius Columna* was the firſt, as far as I know, who uſed the word *Petalum*, to diſtinguiſh the leaves of flowers from thoſe parts properly

properly called folia, or leaves *. They are called by ſome *flores* ſimply, or the flowers, and by others *florum bracteæ*, or the thin glittering leaves of flowers.

Now, ſince we likewiſe meet with in ſome flowers as it were ſecondary petala, diſtinct enough from the former, which in the granadilla are by *Tournefort* called *Corolla fimbriata*, in the hellebore *Cornicula*, in the nigella *Corolla*, in the aconitum *Styli duo*, &c. and in general by *Linnæus*, *Nectaria*; it is uſeful, to expreſs by one general name both theſe ſorts of petala; and ſuch a one is the *Corolla* of *Linnæus*: but, becauſe this word denotes many different things among the Latins, perhaps it might be more fitly changed for *Anthus*, in imitation of *Columna*, or with *Jungius* named *Bractea*. However, "There are two ſpecies of "the Corolla, the Petalum and Nectarium; and "four parts of it, Limbus, Tubus, Lamina, and "Unguis.†"

37. The *Stamina*, or *chives*, or *thrums*, are thoſe ſmall buſhy threads, which uſually poſſeſs the middle of the flower and ſupport the apices. The *Apices* are the uppermoſt, thicker, tumid, hollow parts of the ſtamina, like receptacles, which are for moſt part divided into two apartments, and bivalve or open two ways ‡. *Cæſalpinus* calls the ſtamina *Flocci*; and their apices *Linnæus* names *Antheræ*. "When the round bo-"dies with which the ſlender heads of the ſtamina "are

* *Tournefort*, *p.* 70.
† *Phil. Bot.* 86. ii.
‡ *Tournefort*, *p.* 70.

" are crowned become turgid, and the containing " capsula (*or bag, of each apex*) is dried, very " small globules burst out and are dispersed abroad. " These globulets, or as it were atoms, are of " different figures and colours, but they frequent- " ly have a yellow colour *. The stamina rise " either from the calyx; or, and that the most " frequently, from the petala; or, from the em- " bryo of the fruit. The Antheræ adhere to the " stigma (*or upper extremity of the pistillum*) with- " out filaments in the Aristolochia." Phil. Bot. p. 73.

38. The *pistillum*, or *pestil*, *Tournefort* calls that part which commonly occupies the center of the flower amidst the stamina, and is multiform †. The *Stylus*, with *Malpighius*, is the part occupying the center of the flower, which incloses the seed in its cavity, rises up with an appendix, and plays among the stamina. It is known, that the parts of flowers are ingeniously formed for the sake of the stylus, or uterus; for, in this the seed, which is at the last demanded by nature, is curiously guarded ‡. The appendices of the Stylus, *Cæsalpinus* || calls stamina ||||.

" Fructification,

* *Malpig. p.* 63. 64.

† *p.* 70.

‡ *p.* 64.

|| *l.* 1. *c.* 7.

|||| Malpighius *not only calls the whole pistillum, the style, or womb; but sometimes its inferior half* ovarium, *and its superior* appendix ovarii.

" Fructification, is a temporary part of vegeta-
" bles, dedicated to generation, which ends an
" old, and begins a new work. Seven parts are
" appropriated to it. 1. The *calyx*, which is
" the bark of the plant present in fructification.
" 2. The *corolla*, or the inner bark of the plant
" present in the flower. 3. The *ſtamen*, a bowel
" for the preparation of (*what is ſuppoſed to be the*
" *impregnating*) powder. 4. The *piſtillum*, a
" bowel adhering to the fruit for the reception of
" the (*duſt, or*) powder. 5. The *pericarpium*,
" a bowel pregnant with ſeeds, which it ſcatters
" when ripe. 6. The *ſeed*, a part that falls from
" a vegetable, the rudiment of a new one, which
" is vivified by the irrigation (*prolific influence*)
" of the powder. 7. The *receptacle*, the baſis
" by which the ſix parts of fructification are connec-
" ted together." Thus much from the *Phil. Bot.* *p.* 52. But how juſtly it is grounded, will appear from the ſequel. I ſhall only add here, that he makes three parts of the piſtillum, *viz.* the *Germen*, (*or, lower half of it*) the *Stylus*, (*or, greateſt ſhare of the upper half*), and the *Stigma*, (for, he ſo calls the top, or ſuperior extremity of the Piſtillum,) to which the deſcription of the Piſtillum ſeems only to agree.

§ XI.

39. With reſpect to what belongs to the texture and compoſition of theſe parts, the ſubſtance of the interior little ſtem, or footſtalk, as *Malpighius* informs us, *viz.* the pipes and tracheæ, are extended and elongated into the leaves of the flower, which

are furniſhed with every kind of veſſels, and perfected by hanging ſeries, or rows, of utriculi. For moſt part the veſſels do not go forth from a little ſide, but copious ſmall bundles of them riſe up from the baſe, and having produced branches they are elongated in all dimenſions. In the ſame manner alſo, each of the ſtamina is made up of ligneous fibres and air-veſſels, to which the utriculi, or little bags, placed longitudinally, are added *.

All the before-mentioned parts do not occur in all flowers: for, ſome want the involving calyx, others the petala, and others the piſtillum; while, in all fertile flowers, both the piſtillum and the apices of the ſtamina are always preſent; which therefore appear to be the moſt eſſential parts. But concerning the uſe of the apices, and their duſt, Botaniſts do not yet agree.

40. For, *Cæſalpinus* † ſays, "The Oxycedrus "and the Taxus, bear fruit, but do not flower; "and, of the herbaceous kind, the Mercurialis, "Urtica, and Canabis do the ſame; of all which "they call the barren *males*, but the fruit bearing *females*. Yet, of the former kind, or males, "they ſay that the females thrive better, and become more fruitful, if they are planted near them, "as is obſerved in the Palm Tree; as if a certain "vapour, breathed out by the male, compleatly "diſpoſed the ſlack heat of the female to fructification."

And *Ray*, "What the uſe of theſe parts is, is "doubted: ſome think they are given to flowers "for

* *Raii Hiſt. Pl. p.* 16.

† *l.* 1. *c.* 7.

" for the ſake of ornament; and others, to diſ-
" charge the matter which retards the produc-
" tion of the ſeeds, that the reſidue may become
" purer and freer of dregs, and therefore are as
" it were emunctories. But our *Grew*, is of opi-
" nion, that the ſtamina not only have this uſe,
" but likewiſe *thinks* that *the powder*, or globules,
" with which the apices are filled, and which
" at maturity they throw out like male ſperm,
" *ſerves to fœcundate the ſeed*; and therefore that
" moſt plants partake of both ſexes.*"

Grew's opinion pleaſed very many Botaniſts; and firſt of all *Ray* †; next, *R. Camerarius*, &c. yet ſome of them, without mentioning the author's name, delivered and boaſted of it as their own; eſpecially Mr. *Geoffroy* ‡, and Mr. *Vaillant* ||. And others earneſtly endeavoured to eſtabliſh it by various arguments, as *Ray* himſelf, *Camerarius*, &c. But among all theſe the celebrated *Linnæus* ſhines; who writes thus:

" That the antheræ and ſtigmata conſtitute the
" ſexes of plants, was diſcovered, and has been
" deſcribed, and received as an infallible truth by
" thoſe that cultivated palm-trees, by *Millington*,
" *Grew*, *Ray*, *Camerarius*, *Geoffroy*, *Morland*, *Blair*,
" *Juſſieu*, *Bradley*, *Royen*, *Logan*, &c. nor can it be con-

* See *Grew's Anat. of Plants*, *p.* 171. and *Raii Hiſt. Pl. p.* 17.

† See *the laſt cited place*, *and the preface to his Sylloge exter. Stirp. edit.* 1694.

‡ *Memoires de l'Acad. des Sciences*, *An.* 1711.

|| *Sebaſtiani Vaillant Sermo de ſtructura florum. Lugd. Bat.* 1718. *in 4to.* See this tract *paſſim.*

" cealed from any one who will view the flowers " of every plant with open eyes; as is demon- " ſtrated in the *Sponſalia Plantarum*, printed at " *Upſal* in 1746. in 4to. *" And elſewhere, " That *the generation* of vegetables is finiſhed " by means of the fall of the powder of the antheræ " upon the naked ſtigmata, whereby the powder " is broken, and breathes out *a ſeminal aura*, " which is abſorbed by the humour of the ſtigma, " the ſight, proportion, place, time, ſhowers, thoſe " that cultivate palm-trees, nodding flowers, ſuch " as are ſunk under water, ſyngeneſia, yea, the " proper inſpection of all flowers, confirm †;" which is talking poſitively enough.

§ XII.

41. Yet, on the other hand, the moſt famous *Tournefort* and *Pontedera*, howſoever properly they viewed and contemplated flowers, admit no ſuch generation, or uſe, of the powder. *Pontedera* indeed expreſsly aſſerts, that the liquor of the apices is not neceſſary, in all plants, to the fœcundation of the embryo; and endeavours to evince it by many conſiderations ‡. But it is plainly demonſtrated by the experiments of *Camerarius* himſelf.

For, if one fruit-bearing plant, or ſolitary female of Hemp, or Dog's Mercury, or Spinage, cultivated out of any contagion of, or communication

* *C. Linnæi Syſtema Naturæ, editio ſexta, Lipſiæ* 1748. *in* 8*vo. vid. p.* 216.

† *Phil. Bot.* § 145.

‡ *Vid. P. Anthol. l.* 2. *à p.* 107. *ad* 185.

nication with, a neighbouring male, produces fertile ſeeds; then the powder, or liquor, of the apices, is not requiſite to the fœcundation of the embryo in all plants: now *Camerarius* * ſaw a ſolitary female plant of Hemp, and Dog's Mercury, and Spinage, cultivated out of the infectious influence of any neighbouring male, produce fruitful ſeeds: Therefore the liquor of the apices is not neceſſary to fœcundate the embryo in all plants. But that the generation of vegetables may be brought about without the falling down of the duſt of the antheræ upon the naked ſtigmata, the ſight of *Camerarius* declares and confirms; and I myſelf have alſo ſeen the ſame thing. For, in the ſpring of the year 1737, I tranſplanted from one part of the garden into another, at the diſtance of about two hundred and forty Engliſh feet, between which parts, five, pretty high, thick, and living hedges intervened, three new young plants of the Spinacia vulgaris T.; and before any Spinage had begun to grow into a ſtalk. By accident, all the three were fruit-bearing plants, and yielded plenty of prolific ſeeds; for, when ſown, they ſprung and grew as well as any ſeed of Spinage is wont to do. Hence I began to doubt of this Theory.

42. And, that I might be ſtill more aſſured, whether the duſt of the apices contributed to the fruitfulneſs of ſeed, I made trial of the Mercurialis and Cannabis J. B. and found that one ſolitary female of the former, diſtant from all males more than two thouſand feet, and one of the latter removed from all others above a mile, nevertheleſs abounded

* *Miſcel. cur. Dec.* 3. *an.* 3. *app. p.* 31.—40.

abounded with fertile ſeed. *Tournefort* * obſerved the ſame thing in Hops, *Philip Miller* † in the Bryony, and *Geoffroy* himſelf ‡ almoſt the ſame in the Dog's Mercury. I therefore pronounce the aſſertion of the moſt famous *Pontedera* to be a moſt certain fact. But, let us hear the Sponſalia Plantarum.

" Yet it ſometimes happens, that the ſeed bearing " Hemp carries one or two ſtaminiferous flowers, " by which ſome females may be impregnated; " which deceived *Camerarius*." Thus Mr. *Wahlbom* ||. This is certainly to deceive remarkably, not to ſay any thing more harſh. Such flowers I never ſaw in the ſeed bearing hemp, nor did I ever before hear of them. In my plant, he certainly never ſaw them, nor in the others abovementioned. This ſeems to cut, and not to untye the knot. And, if that is the caſe, authority againſt tried experiments is of no avail, nor arguments drawn, from *place*, *time*, &c.: yet, ſome of theſe I ſhall examine and endeavour to overthrow.

§ XIII.

43. *1ſt*, The moſt trite argument is that taken from *the caſtration* of flowers, as they love to ſpeak.

* *p.* 69.

† *The Gardener's Dictionary. By Philip Miller. Sixth Edition. London* 1752. *in folio. The ſame abridged by the author. Fourth Edition. London* 1753. 3 *Voll. in* 8*vo.*

‡ *Mem. de l'Acad. des Sciences, an.* 1711.

|| *Amæn. Acad. Vol.* 1. *p.* 99.

ſpeak. "If we take away the antheræ of any "plant which bears only a ſingle flower, and take "care that no other plant of the ſame ſpecies be "with it, the fruit miſcarries, or at leaſt it brings "forth ſubventaneous (*or barren*) ova, (*or ſeeds*); "which is ſo certain, that any one may try it with "uninterrupted ſucceſs *." This is certainly gratis dictum, ſince he cannot ſay that he has tried it in all ſuch plants: and though this be granted, it proves nothing; becauſe a wound in an otherwiſe neceſſary part, or the loſs of juice, might be the cauſe of the abortion. "Having often pulled "off the leaves of a flower, before they were "opened, particularly in the *Tulip*, I waited to "ſee whether the ſtylus would afterwards grow; "and ſometimes *I obſerved* that its growth *was* "*hindered*, and ſometimes that ſome ſeeds, hav-"ing ſuffered no harm, arrived at their due mag-"nitude †." But moreover, I tried the experiment with no ſucceſs: for, (in the beginning of the laſt ſummer, *viz.* 1752) I took away from two Tulips growing together, all the antheræ, while they were unripe and intire, the petala, as muſt be obſerved, being ſtill ſhut, which I cautiouſly opened a little; notwithſtanding this, they both ripened the fruit, which was loaded, as it uſually is, with ſeed, though there was no other Tulip in the ſame diviſion of the garden, and which was incloſed with living hedges. But when in a former year, from two Tulips growing in the ſame place, together with the apices, the ſtamina were alſo plucked off, the fruit of both of them became abortive;

* *Sponſ. Pl. p.* 86.
† *Malpig. p.* 70.

abortive, or withered, and afterwards ceased to grow. See *Philip Miller*'s experiments on Tulips, in his Dictionary under the word *Generation*, near the end.

44. 2*dly*, Another argument is drawn from the culture of palm-trees. *Theophraſtus* ſays, "That the fruit can never continue on the female "palm-tree, unleſs the flower of the male has "ſhaken its powder over it; and this indeed "ſome ſay, is truly peculiar to it; but it is like "the caprification" (*or, bringing to maturity the fruit of the wild fig-tree, with the help of the wounds of inſects, or gnats, which feed upon its juice, by planting it in a place where theſe animals breed, or collecting and throwing them into the tree, whoſe figs unwounded would frequently fall off unripe*;) "of fig-trees, by means whereof their fruit "is brought to perfection. Therefore any one will "affirm that the female is not able of itſelf to "perfect it. Yet this ought to appear not in one, "or two, but even in all, or moſt kinds. For, "we thus judge of the nature of the kind. And "though there are few kinds of the palm-tree, it "is ſurpriſing that no account can be given of it, "ſince the cauſe of caprification is thought to be "conſpicuous*." And elſewhere, "The male "palm-trees are of ſervice to the females. For, "hereby the fruit is made to continue and ripen. "Whence it is ſaid, by a certain analogy, to ca-"prificate: It is done in this manner. While "the male is in flower, the involucrum or cover-"ing out of which the flowers come being cut "away, they immediately ſhake the flower, "which

* *De cauſ. pl. l.* 3. *c.* 23.

" which consists of a flowery substance, and down, " and powder, over the fruit of the female. She " is so affected by this aspersion, that she never " loses her fruit, but preserves all of it. Both " the male fig-tree, and the male palm-tree, " seem to lend their assistance to their respective " females: for, the females are called fruit-bear- " ing. Indeed, in the palm-tree, coition is as it " were performed; but in the fig-tree it is caused " by other means.*" What we meet with among the moderns upon this subject, it would be tedious to transcribe. The Reader, if he pleases, may consult *Jo. Leo* †, *Alpinus* ‡, *Mustapha* ||, *Kæmpfer* ||||, *Labat*, *Ludwig*, &c.

45. But *Herodotus* deserves to be heard, since he first of all, even more than a hundred years before the birth of *Alexander the Great* **, wrote concerning the culture of palm-trees. " In the " fields of *Babylon*, (he says), fruit-bearing palm- " trees chiefly grow; from which they not only " procure food, wine, and honey, but likewise in " the same manner as fig-trees are managed. For, " they tye the fruit of those palm-trees, which

* *De hist. pl. l.* 2. *c.* 9.

† *Harris's Collect. vol.* 1. *p.* 347.

‡ *Prosperi Alpini de Plantis Ægypti liber, cum notis Veslingii. Patavii* 1640. *in* 4*to.*

|| *Tournefort*, *p.* 69.

|||| *Engelberti Kæmpferi Amœnitatum exoticarum, politico-physico-medicarum, fasciculi quinque. Lemgoviæ* 1712. *in* 4*to. Vid. p.* 706.

** *Vid. Sponf. pl. præf. p.* 61.

" the Greeks call males, to the glandiferous (*or*
" *fruit-bearing*) palm-trees, that a gnat (*Culex*)
" which enters them may ripen the fruit, leſt it
" fall down from the tree. For, the male palm-
" trees bear gnats in the fruit, as if they were ca-
" prificous." Thus *Herodotus* in *Clio*, as it is de-livered by *Bodocus à Stapel* * ; who elſewhere † alſo writes as follows: " Husbandmen to this very
" time, as the moſt learned *Guillandinus* relates,
" in *Arabia*, *Ægypt*, *Meſopotamia*, *Judæa*, *Phœnicia*,
" and all *Syria*, being deſirous to prevent the fe-
" males degenerating either into a ſtate of barren-
" neſs, or loſing their fruit before maturity, they
" ſo plant in rows the palm-trees of both ſexes,
" as the males are only at leaſt ſo far diſtant from
" the females, that the powder, taken away, by
" blaſts of winds, from the leaves of the males,
" may fall on the leaves of the females; and that
" is found ſufficient to fœcundate and ripen the
" fruit. But, it is wonderful to be related, if any
" female ſtand at a great diſtance from a male, ſo
" that neither the powder, nor breath or ſmell of
" this can make its way to it, the planters have
" contrived *to ſtretch a rope from the male to the*
" *female*, *each extremity of which is tied to each*
" *tree*; and thus as it were the female, being
" coupled with a bond of wedlock, by the in-
" fluence of the male creeping ſecretly along the
" cord,

* *Theophraſti Ereſii de Hiſtoria plantarum libri decem* (novem potius), *quos illuſtravit Joannes Bodæus à Stapel. Amſtelodami* 1644. *in folio*. *Vid. p.* 115.

† *p.* 103.

" cord, is made fruitful, which before became " barren in that ſolitude." It is indeed evident, that inſects may creep along a cord; but, who ever ſaw a powder creeping in the ſame manner?

46. Beſides, the neceſſity, yea and even the truth of ſuch a culture of palm-trees themſelves, are deſervedly doubted of. " When in the ſouth " part of *Spain* where the river *Bætis* runs, named " *Andaluſia*, which abounds with palm-trees, I " inquired of ſome very ſenſible men concerning " this matter, I could get no certain intelligence. " I can however ſpeak of the Hops with more cer- " tainty. In the royal garden at *Paris* it grows " luxuriantly and is every year burthened with " fruit. But that which bears flowers, is not to be " found, except in the iſlands of the rivers *Seine* " and *Marne*, which are at a great diſtance; yet " in the royal garden it produces ſeeds. *" Mr. *Wahlbom*'s anſwer with regard to the Hops is this †. " The Hops (*which he calls Humulus*) is certainly " of two kinds; the one is proud with ſtaminifer- " ous, and the other with piſtilliferous flowers; " and that which they commonly call the fruit, is " only the explicated and elongated *calyx*: hence " although there is a female Hops, and it be not " fœcundated, yet it can bring forth cones. See " the *Iter Gottland.* 275. This deceived *Tourne-* " *fort*, ſo that he would not acknowledge the ſexes " of plants, ſince the hops (female) grew luxu- " riantly in the garden at *Paris*, loaded every " year with fruit, but what bore flowers (the

* *Inſt. p.* 39.

† *Amæn. acad. p.* 99.

" male) did not occur unleſs in the iſlands of the " *Marne* and *Seine* at a conſiderable diſtance, *p.* 69. " The ſame thing happens in the Mulberry Tree " and the Blite, whoſe berries are the ſucculent " calyces, and by no means pericarpia or ovaria," (*or proper receptacles of the ſeed*). In this manner the author of the Sponſalia trifles again. Wherein, I pray, is *Tournefort* deceived? He diſtinctly gives the characteriſtic, and accurately paints the flowers and fruit*; ſo that without the the benefit of *Tournefort*'s table of the Lupulus, the character of the Humulus in *Linnæus*'s Genera Plantarum † is not eaſily underſtood. At leaſt Mr. *Wahlbom* does not well underſtand him. For, he ſeems to blame *Tournefort*, becauſe he calls the fruit cones; though " what they commonly call the " fruit, is only the calyx explicated and elongat- " ed." But it is really the fruit according to *Linnæus* himſelf; for, " the eſſence of a fruit con- " ſiſts in the ſeed.‡" And " the fruit is known " by itſelf from the ſeed, whether it be covered " with the pericarpium (*fruit or ſeed-veſſel*), or " not ||." Yea, it is proud with piſtilliferous flowers, according to Mr. *Wahlbom*: therefore theſe cones, or elongated calyces, are really the fruit. But, whether it be the fruit, or be not the fruit, is of no conſequence, ſince *Tournefort* adds in expreſs words, " in the royal garden it brings forth " *ſeed*." The Sponſalia omit theſe things, though the queſtion is only concerning the ſeed. What

is

* *p.* 535. *tab.* 309.
† *p.* 477.
‡ *Phil. Bot.* § 88.
|| *Ibid. p.* 56.

is to be seen in the *Iter Gottland*. I know not; but the hops sold here are full of seeds; although the *Humulus* which is proud with pistilliferous flowers is only cultivated. As to the Mulberry Tree and the Blite, they have almost nothing common with the Hops. Yea, in the Blite "the Pericarpium "is a very small capsula (*or bag*), and the crust "of the seed is commonly oval, and a little flat," according to *Linnæus* *. But to return to the palm-tree.

§ XIV.

47. What accounts are handed down to us concerning the culture of palm-trees, do not agree well amongst themselves, as will easily appear to any one who will compare the cited authors. *John Bauhine* says that he saw, at *Montpelier*, an extraordinary palm-tree flowering in the spring, and also bearing sufficiently large dates in the autumn. "I have likewise, *he says*, both flowers "and dates gathered from the tree. It is be- "lieved to be above an hundred years old; and "it is a common perswasion there, that it does not "bear fruit till it has arrived at a great age, and "scarce before the fiftieth year, as some report- "ed.†" This late commencing fructification of palm-trees seems to have given rise to some fables; such as that of *Jovianus Pontanus*, who in a poem celebrates

* *Gen. pl. p.* 5.

† *Historia plantarum universalis, auctoribus Johanne Bauhino, & Joh. Henr. Cherlero. in* 3 *Voll. Ebroduni* 1650. & 1651. *in folio. Vid. Vol.* 1. *p.* 360.

celebrates two palm-trees, the one a male at *Brundusium*, the other a female at *Otranto*, which continued long barren, while, to wit, by little and little they were springing up, and the one could not yet look stedfastly at the other: but, when they were grown up so tall that they could *see* one another, though at the distance of no less than many furlongs, they began to bear fruit *. It seems also to have occasioned those other stories concerning the amours of palm-trees, in *Pliny*, and which we have more at large in the *Geoponics* of the *Florentine* (*Virgil*). "Howbeit, (says *Pliny*, "treating of palm-trees †), they ascertain the fact, "that the females do not procreate without the "males, yet the woods produce them naturally: "and that many of them incline round a single "male, complimenting it with their branches and "leaves bended forwards. That this having "erected its shaggy leaves, by its breath, and "sight itself, and also by its dust, marries them "(or is married by them). If this tree be cut "down, the female widows afterwards become "barren. And therefore there is a venereal in-"tention, like moreover the coition which is in-"vented by men, from the males sprinkling upon "the females their flower and down, but in reality "only their powder." Thus *Pliny*. *Cassianus Bassus*, *l.* 10. *c.* 4. relates these things more elegantly in this manner: "But yet the palm-tree "itself loves, and indeed ardently, another palm-"tree, as the *Florentine* in his *Georgics* acquaints us; "nor does its first desire cease, till its beloved

"comforts

* *Ibid. p.* 363. *vel Bod. in Theoph. p.* 103.

† *Hist. nat. l.* 13. *c.* 4. *p.* 320.

" comforts it. For, one may see the tree itself " bended, and neither satisfied with the ground " it stands on, nor producing fruit. And this very " thing is known to the husbandman: for, he " knows that it loves, but he is ignorant of what " it loves, &c." Whoever delights in these idle tales may read *John Bauhine* *, or *Bodœus à Stapel* on *Theophrastus* †. Because, by these two authors, most things, if not all, that are taught concerning the fœcundation of palm-trees, are delivered. Yea, it seems to be very certain, that a solitary date-bearing palm-tree hath produced ripe dates; but whether the stones of such dates are fertile, I dare not yet determine. Howsoever, whether they are fruitful, or unfruitful, it is of little signification towards establishing the general doctrine, since it is a single example, as *Theophrastus* ‡ informs us, especially as many things evince the contrary.

48. 3dly, Another class of arguments is borrowed from a comparison of vegetables with animals ||. But analogy alone proves nothing. It is a vulgar saying, that every thing which is like another is also unlike it. They accord in many things; but it does not thence follow, that they agree in all. " In short, (says *Theophrastus* ||||), all " things ought not to be admitted as alike even " in animals. For, there is every where a power " of growing, because even on every side there is " something

* *Vol.* I. *p.* 362. & *seq.*
† *p.* 103.
‡ *Vid.* No. 44. *supra.*
|| *Vid. Fund. Bot.* § 132. *ad.* 150.
|||| *De hist. pl. l.* I. *c.* I.

" ſomething endued with life." And *Malpighius* * obſerves, " In vegetables, where there is not ſo " great an apparatus of organs, and in every ſen- " ſible particle of them there are all things which " are found in the whole, *without any interpoſed ge-* " *neration*, whatſoever branches are cut off them " grow up into new buds or ſhoots; even by the " aſſiſtance of nature, the very ſmall and com- " pendious little plants which fall off tender " twigs, under the form of ſeeds, perpetuate pro- " pagation every year." Hence plants are often more ſucceſsfully and more eaſily propagated by gems, than by ſeeds: hence *Garlick*, *Onions*, *Leeks*, &c. bear gems in the place of roots, and likewiſe on the tops of their ſtalks, inſtead of ſeed: and hence likewiſe the ſeed of the *Sow-bread*, as *Cluſius* † takes notice, committed to the ground, is not changed into a germ, but converted into a tubercle or little root, contrary to the nature of other ſeeds, from which it afterwards brings out leaves. Such like young ſhoots or buds *Cæſalpinus* ſaw on the tops of the leaves of the herb named *Moly*; they frequently occur on the ſtems of *Tulips*; and the bulb-bearing *Lilies* are known to every one. But what is a gem?

49. " A young ſhoot, or bud, differs from a " ſeed, as a living fœtus from its ovum. For, a " ſeed is as it were an egg, in which there is a " vital principle, but nothing of life: but a gem " lives, at firſt indeed by its parent, as its germ, " but

* *Anat. pl. p.* 76.

† *Caroli Cluſii rariorum plantarum Hiſtoriæ Antverpiæ* 1601. *in folio. Vid. p.* 264.

" but afterwards by itſelf, and draws moiſture " from the earth by its own roots," *Cæſalpinus* *. " Gems are as it were the infant, or fœtus ſo ſe- " cured, that being increaſed in its own time, and " growing up into a young branch, it at laſt pro- " duces ſeeds. A ſeed therefore probably is as it " were a pendulous gem, and which falls off its " parent, it being about to germinate in another " piece of ſoil," *Malpighius* †. And in a learned treatiſe, intitled *Gemmæ Arborum, à Petro Loſling Madelpado*, it is thus deſcribed, " A gem is a part " of a plant ſeated upon the root, which covers " with ſcales, that are the rudiments of leaves, " the embryo of the future herb ‡." And elſe- where ||, " I therefore conceive a gem to be like " an herb reduced into a compend, covered, and " contracted with its outmoſt leaves, that it may " be preſerved from the injury of the air; which " herb wants nothing farther, but a power of ex- " tending itſelf: and this heat at laſt excites." A gem therefore is a little plant, or embryo of a plant, with its proper involucra or coverings. " That vegetables, (ſays *Linnæus*) come forth " from an egg, reaſon and experience often de- " clare; and that the ſeeds of vegetables are their " *ova*, the end they anſwer informs us; which is, " to produce buds or young ſhoots exactly like " their parents. That generations of plants from " a ſeed and gem are coæval, the inſpection of " gems and the wantonneſs of bloſſoms teach.

* *l.* 1. *c.* 5.
† *Anat. pl. p.* 39. & 77.
‡ *Amæn. acad. vol.* 2. *p.* 185.
|| *p.* 192.

" The ſeed properly, is the new rudiment of a " vegetable, moiſtened with an humour, and " coated with a bladder *." Therefore a ſeed is a gem, or a young ſhoot or bud that falls down, or the embryo of the plant, or a little plant with its coverings. Conſequently a gem may be properly enough and truly called another ſeed, or a more perfect ſeed. But Mr. *Loſling* † ſays, " Thoſe " that repreſent a gem to themſelves as another " ſeed, deceive and are deceived;" how truly, let others judge.

50. If, therefore, gems are as it were more perfect ſeeds, and come forth plentifully out of moſt plants, eſpecially when lopped, or pruned, yea, out of the ſmootheſt parts of the bark; and if a very ſmall part of a plant often grows up into a new ſhoot, or puts forth gems, without any diſtinction of ſexes or bloſſom; what, I pray, analogically forbids us to conclude, that *ſeeds*, thoſe more imperfect gems, are produced, without the falling down of the powder of the antheræ upon the ſtigmata, or any intervening generation?

§ XV.

51. But, according to *Linnæus*, *the ſight* often declares the contrary. What does out ſight often tell us? Famous authors give a threefold anſwer to this query. " Autopſy itſelf (ſays *Joh. Geſ-* " *nerus*),

* *Vid. Phil. Bot. p.* 88. 89. & 54.
† *Amœn. acad.* 9. *p.* 185.

" *Gesnerus* *), certifies this Act of generation. " The first person that saw the marriages of " flowers, was the celebrated Mr. *Sebastian Vail-* " *lant*, who in a particular little treatise on the " structure of flowers, describes them so elegant- " ly, that no body can have any doubt left about " this matter; notwithstanding the different sen- " timents of the famous *Pontedera* and *Siegesbeck*, " who, in broad day-light, do not acknowledge " the sexes and generative act of plants. But the fa- " mous *Vaillant* talks in this manner: How often has " it happened, that one and the same plant bears " at one and the same time flowers, some of which " are only female, but others are male and female " conjoined (*or hermaphroditical*), that these sur- " round the organs (*he means those of generation*), " and an erection and swelling of the male organs " happen in them so suddenly, that the lappets " of the flowering gem give way to or retire by " the force or impetus, and here and there expand " themselves with a truly wonderful velocity; *nor* " *do they sooner find themselves at liberty and pre-* " *pared, but that* they immediately and as violently " as possible explode and throw out (*of the apices*, " *to wit*) at one impetus or effort all their impreg- " nating generating seed (*genitura*), to wit, by " diffusing a little cloud of dust, which spreads

I 2 " every

* *Johannis Gesneri Dissertationes Physicæ de Vegetabilibus, in quibus Elementa Botanica celeb. Linnæi diluci de explicantur; conjunctim cum C. Linnæi oratione de necessitate peregrinationum intra Patriam. Lugd. Bat.* 1743. *in* 8vo. *Vid. Dissert. p.* 89.

" every way the fœcundation of the before unim-
" pregnated female genital organ (*arvi genitalis*)?
" This venereal interlude is ſcarce ended, before
" the lips or lappets of the flowers immediately
" come near together, and indeed with the ſame
" violence of celerity or impetuoſity by which
" they had receded from one another, and ſo in-
" ſtantly regain their priſtine form. Any one
" may eaſily ſee this artful apparatus in the *Pa-*
" *rietaria* (*or Pellitory of the wall*). But he muſt
" approach it at the hour devoted to venery! It
" is the morning that favours theſe rencounters;
" but when they refuſe to perform them at a ſuf-
" ficiently ſeaſonable time, you may even force
" them thereto, if you do but ſtimulate, or prick
" them gently, with the point of a ſmall needle.
" In hermaphrodites, where the two ſexes are
" joined together, there is very far from being ſo
" great and impetuous an exploſion: for, moſt
" flowers, eſpecially the nodding, or ſuch as hang
" down their heads, in which the piſtillum is
" placed obliquely within the ſtamina, exerciſe
" the act of generation with their flowers ſhut,
" while the ſtigma (*or ſuperior extremity of the*
" *piſtillum*) is contained within the middle of the
" antheræ (*or apices*)." Thus far Mr. *Geſner*.

52. But, with deference to *Geſner*, *John Bauhine*, who died above fifty years before *Vaillant* was born, hath deſcribed in a few words *this artful apparatus in the Parietaria*, without any ſilly poetical flouriſhes. " The little flowers of the
" parietaria, which are crowded about the ſtalk,
" and grow out of the lower extremities of the
" ſtems

" ſtems of the leaves, reſemble locks of ſcarlet " ſilk, immediately after they ſtart out of the " little knot of the ſtem: after them the ſtamina " appear obſcurely, wrapt up among the purpleiſh " white little apices; which if you endeavour to " unfold with a pin, the powder is caſt out by " jumps with force, when it is pleaſant to behold, " that the floſcules are bent backward and expand " themſelves, ſo as to ſurround the rudiment of " the ſeed which is in the middle." Thus *John Bauhine*, *vol.* 2. *p.* 976. And the ſame may be read by any one in *Moriſon* *, and *Ray* †; though *Vaillant* delivers it as properly his own obſervation.

" In the *parietaria* two hermaphroditical flowers " are contained in a plane covering conſiſting of " ſix leaves, and one female flower, betwixt the " two hermaphroditical flowers, and within the " ſame covering." *Lin.* Gen. pl. p. 494. Hence this violent and ſudden exploſion ſeems rather to certify, that this powder of the apices is entirely uſeleſs to the germina (*or top of the peſtil*), if not hurtful. For, the ſtamina incloſed with the germina in a common involopment, do not caſt out their duſt, before that by erecting themſelves, they here and there expand the lappets of the gem, or leaves of the involopment; and they no ſooner find themſelves at liberty, and high enough raiſed in the air above the involucrum, but that they

* *Plantarum Hiſtoriæ univerſalis Oxonienſis, auctore Roberto Moriſon. pars* 2. *Oxonii* 1680. *Pars* 3. *ibid.* 1699. *in folio. Vid.* 2. *p.* 600.

† *Hiſt. pl. p.* 206.

they immediately explode and throw out moſt violently, and at one effort or impetus, all their powder: and as if there was fear, leſt any particle of this noxious duſt ſhould fall down upon the ſtigmata of the peſtils, which are much ſhorter than the ſtamina; and when the exploſion is finiſhed, the lips or lappets of the flowers, that is, the leaves of their covering, inſtantly come near together, with indeed the ſame impetuouſneſs by which they retired from each other, and immediately reſtore themſelves to their former ſituation. "In "ſuch a manner indeed, (adds *Vaillant* *), that "it would be very difficult to believe, that theſe "flowers have ſuffered any violence, unleſs even "the eye itſelf had ſeen this act, or ſhould "yet ſee the decaying ſceletons of magnanimous "heroes, for a little while erected on a field of "battle, where, like banners, they ſuſtain the "conflicts and jocular ſportings of the flying weſt "wind." What is clearer than this? Of what ſort is this autopſy?

53. But Mr. *Wahlbom* ſeems to have been of a different opinion; at leaſt he differently explains theſe words, *the ſight often tells* or *confirms*: for he ſays, "That theſe things are thus performed "in plants, *the ſight* in the firſt place frequently "informs us. It is at firſt ſight obvious, that "while a flower is in bloſſom, and the powder "of the antheræ flying about, this powder does "ſtick to the ſtigma.†" Yet it is not at all obvious that generation is thus performed. Nor from

* *De ſtruct. fl. p.* 9.

† *Amæn. Acad. p.* 90.

from the floreſcence of the *Viola* tricolor, B. P. the *Gratiola*, *Iris*, *Campanula*, and *Syngeneſious* plants tyed down to it; or from any of theſe obſervations, howſoever obſcenely, related: while the poſition of the antheræ, in the Iris and Campanula, manifeſtly ſhew to the eyes, that the falling down of the powder upon the ſtigmata is impoſſible. But let us hear the moſt famous *Linnæus* himſelf.

54. " That *the generation* of vegetables is thus " brought about, the *ſight* confirms: That the duſt " enters the germina, *Morland* believed; that itſeſ- " ence is extracted by means of the moiſt ſtigma, " *Vaillant* determines; that the powder of the Ma- " ple is broken in the humour, *B. Juſſieu* ſaw; and " that all the powder explodes in the humour a " ſeminal aura, or breath, *Needham* confirms." Thus the Phil. Bot. p. 91. *Vaillant* redargues moſt manifeſtly the opinion of *Morland*; who determines that the volatile ſpirit, or vapour, or breath of the powder, enters the tracheæ of the tubæ (*or piſtilla*) by their extremities; but I do not find in him one word of extracting the eſſence of the powder, or moiſture of the ſtigma. And if all the powder be broken in the humour, how it thence follows that they explode in ſuch a manner a ſeminal aura, I do not ſee; eſpecially ſince it by no means appears, that the ſtigmata ought to be wet with an humour in order to fertility; and " in almoſt all flowers it is ſeen how they " expand themſelves in the ſcorching ſun; but " in theevening and in a moiſt air, they fold toge- " ther their floſcules, leſt water ſhould come to and " coagulate the powder, by which means it could

" not

" not be blown to the ſtigmata. *" *The ſight* therefore ſeems to tell nothing often, nor confirm any thing concerning the generation of plants tyed down to it.

55. If theſe moſt famous ſexualiſts had obſerved the floreſcence of the *Urtica* urens maxima B. P. they might have thence deduced a more ſolid argument to eſtabliſh the opinion of *Vaillant*, than from the *Parietaria*. For, no one can look on this barren herb, in a dry ſummer, for ſcarce one or two minutes of time, without ſeeing frequent and ſudden exploſions of the powder of the apices. But this is a ſingle example; nor are we hitherto ſurpriſed with any ſuch thing in the Mercurialis, Spinacia, Cannabis, or any other barren plant.

56. That the generation of vegetables happens in the before-mentioned manner, *proportion* confirms †. " From proportion too, (ſays *Geſner* ‡), " we judge it to be very likely, ſince according " to the ſize and number of the ſeeds, the ſtamina " themſelves are likewiſe larger, or more nume- " rous." But he is quite miſtaken, as by comparing the Monandriæ with the Polyandriæ of *Linnæus* will eaſily appear. " *Proportion* in the " ſecond place frequently declares the ſame thing. " For moſt part the ſtamina and piſtilla are of an " equal height, that by this means the powder, " with the help of the wind, may come to the " ſtigma the better; but in ſome plants they are " not

* *Amœn. Acad. p.* 93.
† *Phil. Bot. p.* 91.
‡ *Diſſ. p.* 90.

" not equally high, where a ſingular proceſs of " fœcundation is obſerved." Thus the Sponſ. plant *. *For moſt part*, truly it often declares nothing, eſpecially ſince in many plants it occurs otherwiſe; as in the Crocus, Iris, Phalangium, Lily, and moſt of this claſs, not to mention others, where no ſingular proceſs of fœcundation is obſerved: yea, of the ſix plants mentioned by the author, in which ſuch a proceſs is ſaid to obtain, three of them, *viz.* the Dianthus, Nigella, and Paſſiflora, have their piſtilla raiſed high above the ſtamina, nor do they touch them when bended, the ſtigmata being conſtantly elevated above them; while in the mean time the antheræ open on their loweſt ſide, the powder is only dropt or falls down; as if the ſtigmata were as much as poſſible to be ſhunned, leſt they be hurt by the odious powder.

The argument from proportion Mr. *Linnæus* thus illuſtrates. " *Proportion*: That the ſtigmata bend " themſelves to the antheræ, and are then ſtretched " out, appears from the *Dianthus*, *Paſſiflora*, and " *Nigella*. When the piſtillum is very ſhort, the " antheræ open and cloſe above the ſtigmata; as " in the *Saxifraga* and *Parnaſſia*. The antheræ " open and cloſe while they blow out the powder " in the *Celoſia*. The corolla preſſes with its " fingers the antheræ to the ſtigmata in the *Teu-* " *crium*." Phil. Bot. p. 91. But what then? Here is nothing ſaid of the proportion often telling or confirming that generation is accompliſhed in the aſſigned manner. Here cauſes of inequality are aſſigned, but no inſtance is given of proportion.

* *Amæn. Acad. p.* 90.

tion. It is therefore of little moment, whether these things are so, or not. What things are written concerning place, time, showers, nodding flowers, &c. it is easy to confute by examples; but what has been said may suffice.

§ XVI.

57. Various other arguments, against the doctrine of the sexes, are to be taken from the less perfect plants; subterraneous and submarine fructification; the structure of flowers; even their right inspection, &c. Who ever saw the antheræ and stigmata in all the species of the sixteenth and seventeenth classes of *Tournefort*'s Institutions, or of the Cryptogamiæ of *Linnæus*? Who will believe, "That all kinds of vegetables are furnished with "a flower and fruit, even where the sight has not "discovered them*? It seems credible enough." But, to avoid prolixity, I forbear to add any thing more concerning these matters. Yet I cannot pass by one or two propositions, in some measure appertaining to them, and which are singular enough.

58. As (1), "In the beginning of things, we "contend that one pair of sexes of every sort of "vegetables and animals was created," Phil. Bot. p. 86 †. And our author's oration *Concerning the increase of the habitable earth* ‡ explains this opinion, the reasons being there given, which perswaded

* *Fund. Bot.* § 139.

† Reason advises it, *Fund. Bot.* § 132.

‡ *Amæn. acad.* 2. *p.* 439.

fwaded him to believe it. It is indeed a new doctrine, but only ſpeculative. Yet, we are not raſhly to aſſent to it, unleſs it be before-hand ſhewn, how one pair of ſexes of vegetables, could be ſufficient to ſupply with food all the pairs of animals in paradiſe; and where they afterwards found aliment, when *Adam* was baniſhed out of *Eden*, and the ground was curſed on account of his tranſgreſſion.

59. (2), " *Harvey* did not without reaſon aſſert " that life conſiſts in the circulation of the blood. " I agree to his opinion, and define *life* to be a " ſpontaneous propulſion of humours. Where there " is a ſpontaneous propulſion of humours, it thence " appears that there there is life: in vegetables " and plants there is a propulſion of humours: " Therefore every one muſt ſee that vegetables " and plants live." Sponſ. plant. * Here he argues logically: but if there is here no typographical error, this is a ſophiſm, conſiſting of four terms; for, *propulſion*, and *ſpontaneous* propulſion are very different. However, though it be granted that life ſuppoſes a ſpontaneous propulſion, yet, it does not thence follow, that ſuch a propulſion is life, ſince it is only the effect of life. Moreover, it does not appear that the humours of vegetables are always propelled, or are always in motion, much leſs that they are ſpontaneouſly propelled, ſince their motion is neceſſary, and depends intirely on external cauſes, " *and alſo that they are not* " *found to have any voluntary motion.*" Phil. Bot. p. 93.

* *Amœn. Acad. p.* 64. & 65.

60. (3), " I would have it likewiſe be attend-
" ed to, that the *Calyx* ariſes from the exterior
" bark of the plant; the *Corolla* from the interior
" bark; the *Stamina* from the nouriſhing albur-
" num (*or that part of the wood of a tree immé-
" diately under the inner bark, called the ſap,
" which is commonly white*); the *Pericarpium*
" (*or receptacle of the ſeed*) from the woody ſub-
" ſtance; the *Seeds* from the pith of the tree;
" for, they are placed in this order, and alſo
" opened in this order." Sponſ. plant.* " A ve-
" getable conſiſts of *Pith*, cloathed with *Wood*,
" which is ſeparated from the *Bark*, and covered
" with a *Cuticle* (*Epidermide*)." Phil. Bot.† Thus trees only are to be called vegetables. For, as far as *Malpighius*, *Grew*, *Ray*, &c. could diſcern, trees alone were provided with a bark, an inner bark, and the alburnum or ſappy part. But, " we
" do not doubt, but that in a future time theſe
" parts will be very differently expounded ‡."
It is uſeleſs to inquire what may happen in futurity; but, at this day, the ſtamina ariſe ſometimes from the ſtigma ||, often from the germen, very often from the corolla; the pericarpium from the calyx, or commonly from the piſtillum, &c. Any one, that will, may attend to theſe things.

61. (4), " The antients were abſolutely per-
" ſwaded, that the juice of vegetables which
" aſcends from the root into the trunk, again de-
" ſcends:

* *Amæn. Acad.* I. 104.

† *p.* 37. *Vid. etiam p.* 52. & *Fund. Bot.* § 86.

‡ *Sponſ. pl. Amæn. Acad.* I. *p.* 70.

|| *Vid.* No. 37. *ſuprà.*

" ſcends: but the moſt famous natural philoſopher " *Hales* of the preſent age, has made a ſtrong ob- " jection to this opinion, he having demonſtrated " that this humour which is carried from the root " by the trunk into the ſmall branches, by no " means *does return*, but is evaporated by the " perſpiration of the leaves." Sponſ. plant.* But he does not ſeem to underſtand the celebrated *Hales*: for, he admits, that the ſap in ſome degree does return from the tops of plants, towards their inferior parts; becauſe he relates experiments which clearly ſhew it †: to which, if the obſervations concerning the weeping of the vine, &c. be added, they make ſome ſort of a circulation as it were very probable.

I have likewiſe ſeen a young branch, growing out of a vine in the open air, brought through a hole into a ſtove, in the middle of March, full of vigorous young ſhoots, yea, loaded with bunches of flowers, which before the end of June as I heard, ripened the fruit; that is, three months before the uſual time of vines, growing in the moſt Sunny part of the garden. The moſt famous *Linnæus* himſelf ſays, " Plants have no heart, but " heat effects every thing in them; nor do they " need an heart, where neither the effect of a " perpetual motion is neceſſary, and where there " is a propulſion, and not a circulation of hu- " mours. ‡" But how heating a ſingle branch, while the root remains in the cold earth, is able to

* *Amæn. Acad. p.* 65.

† See *his Statics*, *vol.* 1. *c.* 4. from *p.* 128. to 155. and eſpecially *fig.* 22. 24. 25. 27. 28. & 29.

‡ *Phil. Bot. p.* 88. & 91.

to haſten its fructification in ſuch a manner, without a circulation, I cannot conceive.

62. Concerning the uſe of the ſtamina there are various conjectures. "Thoſe flowers, (ſays "*Pontedera* *), which are only furniſhed with a "calyx and ſtamina ſupporting the apices, I am "of opinion are not to be reckoned flowers, ſince "fruitful flowers always want them. Yet, they "are neceſſary, and extremely uſeful, to the "flowers in which they are found, though they "are ſituated at a great diſtance from the fruit; "as in the Amentaceous plants (*or ſuch as pro-"duce catkins*), the Mays, Lacryma Job, Ricinus, "Typha, and Sparganium; becauſe a reſinous "and volatile juice is conveyed to the fruit by "the footſtalk of the amentum, or catkin. But "in barren plants, I very willingly confeſs I am "ignorant of their uſe." But the flowers which only conſiſt of a calyx and ſtamina in barren plants, have certainly an equal right to be reckoned flowers, as ſuch like in fruitful plants. [See above the ſentiments of *Cæſalpinus* and *Ray*, No. 40]. Perhaps, from the above-mentioned obſervations concerning the powder of the *Parietaria*, it may be concluded, that this powder is quite uſeleſs to the parent; perhaps that it is noxious, and therefore in ſome meaſure may contribute to the variety of flowers, the production of fruits, &c. which are pretty often morbid varieties. Perhaps it may be produced for the ſake of inſects: for, of what ſervice the powder is to the plant, for inſtance, of the barren Hemp, to the fruit-bearing Hemp,

* *Diſſert.* 3. *p.* 51.

Hemp, does not appear, nor perhaps will it ever appear.

§ XVII.

63. It would not be worth while to argue againſt the ſexes of plants, unleſs it had given occaſion to the ſpecious contrivance of a Syſtem, or Method of plants, named ſexual, which of all others, how many ſoever there are, is the moſt intricate, and involved, and unnatural. Becauſe there is no ſyſtem, whether it be orthodox, or heterodox, in which more diſſimilar things are conjoined, and more ſimilar ſeparated; and the knowledge of which, by reaſon of an introduced dialect unknown to the Greeks as well as to the Latins, alſo by reaſon of the looſely changed familiar ideas of words and names, is acquired with greater difficulty. Yea, by the aſſiſtance of *Tournefort*'s Inſtitutions, and a garden well ſtock'd with plants digeſted in his method, a Learner will acquire a knowledge of them much ſooner and more eaſily, (even without a maſter), than underſtand the *Linnæan* nomenclature, but tolerably, though aſſiſted by the explications of the famous *Geſner*, the Sponſalia Plantarum, and Philoſophia Botanica, &c.: while accordingto the ſexual ſyſtem, where trees are confounded with herbs, a methodical *Syntax* or Conſtruction of Plants in a garden is impoſſible. For, although it is of little ſignification what kinds follow immediately one another in a written ſyſtem, yet, in a living one, or nurſery of plants, it is far otherwiſe, ſince as ſhades are hurtful to corn, ſo they are injurious to almoſt all herbs.

"The

" The things neceſſary to make a Botaniſt " (ſays the celebrated *Linnæus* *, are, [a] A li- " brary very valuable on account of its copper- " plates. [b] Almoſt all the books, that were " ever publiſhed. [c] A garden very well fur- " niſhed with living plants, with their various " winter-quarters and ſtoves. [d] A literary " correſpondence almoſt through the whole world. " [e] Journeys into various remote countries. " [f] A ſumptuous education in painting, ſtudy- " ing, reading, and conſulting; yet all theſe, " unleſs he is born a Botaniſt, or is endowed with " a moſt acute genius, never conſtitute a happy " Botaniſt." Therefore a happy Botaniſt will be a rare bird in the earth; but it will be miſerable happineſs! For, it is added, " When any one at " laſt is a Botaniſt, he thence derives no gain, no " recompence: and few offices occur which call " him to their performance." If therefore ſo little, or no advantage, ariſes from ſo great labours, who in his ſenſes will cultivate Botany in this manner, or affect to be a happy Botaniſt?

64. However, Botany is a tedious and difficult ſcience without a method. Therefore, whatſoever ſyſtem, whether it be natural, or artificial, which neither facilitates, nor ſhortens it, is evidently of no uſe; nay, if it introduces various new names, without neceſſity, or terms of art unheard of before, it is altogether hurtful. For, thus, (as the great *Boerhaave* ſpeaks†), the heavy ſtudy of the art, is

* *C. Linnæi Critica Botanica. Lugd. Bat.* 1737. *in* 8*vo. Vid. p.* 73.

† *Ind. præf. p.* 15.

is aggravated by a new ſtudy, and puzzling trifles occaſion Botany to appear both fooliſh and difficult.

The illuſtrious author *of the ſexual ſyſtem* would never have fallen into ſuch miſtakes, if he had not been prematurely prepoſſeſſed in his youth with this plauſible theory of generation. "The ſingular ſtructure, *he ſays*, and remarkable office, of "the ſtamina and piſtilla, enticed my mind, to "inquire what nature had concealed in them. "They commended themſelves by the function "which they perform, ſince on theſe alone the "propagation of plants wholly depends. For, "*a flower is* nothing but *an act of the generation* "of plants.*" Truly a ſingular definition of a flower! Sometimes it is called genital organs, and ſometimes an act of generation; moſt philoſophically.

65. I contend that the generical names, in the ſexual ſyſtem, are very often changed without any neceſſity; and that the rules which the author has preſcribed to himſelf in the Fundamenta Botanica, are quite arbitrary, for moſt part uſeleſs, and frequently deceitful.

For, *1ſt*, He applies the antient names, which he calls *vague*, oftner by far to divers plants, than they have denoted in every age. Thus, for example, [a] *Glechoma*, which he has among the

* *C. Linnæi Claſſes plantarum, ſeu Syſtemata Plantarum omnia à fructificatione deſumpta, quorum xvi. univerſalia, et xiii. partialia. Lugd. Bat.* 1738. *in* 8vo. *Vid. p.* 441.

antiently received names *, for *Glechon*, I suppose (for, I do not find *Glechoma* among the antients), which Greek name of the Penny-royal used by *Hippocrates* himself, he makes the generical name of the Hedera terrestris, vulgaris, B. P. notwithstanding there are other worthy enough synonymous appellations, *viz.* the Chamæcissus & Chamæclema †. [b] *Bubon*, is likewise among the antiently received names ‡: Yet, among the antients, it does not signify a plant, but the groin, or a tumour ||. He therefore should have called it *Bubonium*; and this usually means Inguinal; but with the celebrated *Linnæus*, the Petroselinum Macedonicum Dod. is a kind of Bubon. [c] What *Gomphrena* signifies, I know not, nor is it to be found in the Greeks or Latins, though it is numbered with the antiently used denominations ||||. Perhaps he means *Gomphæna*, which, with *Pliny*, signifies a Species of the Amarantus, not the Amaranthoides of the moderns. In a word, the *Andrachne*, *Antbericum*, *Aizoon*, *Atractylis*, *Comarum*, *Bunias*, *Elatine*, *Erigerum*, *Melia*, *Hibiscus*, *Trichomanes*, *Asplenium*, *Myrica*, *Melampodium*, *Psidium*, *Peganum*, *Carica*, and hundreds of others ‡‡, are ill applied, or wrested into a contrary sense. From such a confusion of names, it is easy to foresee how many errors may take their rise

* *Crit. Bot. p.* 121.
† *Vid. Fund. Bot.* § 244.
‡ *Crit. Bot. p.* 121.
|| *Vid. Fund. Bot.* § 231.
|||| *Crit. Bot. p.* 121.
‡‡ *Vid. Crit. Bot. p.* 119. *ad* 123.

riſe in the ſtudy of Botany and Languages, yea, in Medicine itſelf.

66. But yet, 2*dly*, He rejects the names moſt frequently uſed, for no other reaſon, but becauſe they are neither of Greek nor Latin original; * fooliſhly enough: ſince both Greek and Latin names are often borrowed from foreigners, or Barbarians; ſuch as, the *Amomum*, *Piper*, *Macis*, *Zingiber*, *Piſtacia*, *Caſſia*, *Coſtus*, *Balſamum*, *Iſatis*, *Nardus*, and a great many more: nor indeed is it of any moment, whether they are of a *Lapland*, *Chineſe*, or *American* original, if ſo be they are not very difficultly pronounced, nor offenſive to delicate ears. Therefore, the Adhatoda, Acajou, Alhagi, Alkekengi, Azedarach, &c. are rejected without cauſe as proper to particular countries, or at other times thoſe uſed by *Tournefort*; the Menyanthe, Jalapa, Ephemerum, Xiphium, and Thuya, perhaps being excepted, which are badly applied. "For the nature of etymology ſeems to be of little "importance in this ſubject; ſince it is certain, "that thoſe who firſt gave names to plants, had "no regard to the genus itſelf, but only to one "ſpecies, which its diſtinguiſhing marks pro-"cured it.†"

67. 3*dly*, The moſt famous author condemns *the very long*, and likewiſe the *nauſeous* names ‡. "I call thoſe very long names, which include

* *Fund. Bot.* § 229.
† *T. Inſt. p.* 61.
‡ *Fund. Bot.* § 249.

" more than twelve letters * ;" as the *Anapodophyllum*, *Staphylodendron*, *Bulbocaſtanum*, *Chamærhodendros*, and *Amaranthoides*; though they ſhew better the facies or habitus of the plants, or of ſome part of them, than Podophyllon, Staphylæa, Bunium, Azalea, and Gomphrena †; and he retains Ceratophyllum, Chryſoſplenium, Dracocephalum, Meſembryanthemum, Tabernæmontana, Tetragonotheca, and Trichoſanthes.

" I call thoſe *nauſeous* or *nauſeating* appella-
" tions, *he ſays*, which keep no ſimilitude to the
" reſt in botanical books, but are quite different
" from, or foreign to them, and to me ſeem as it
" were to be barbarous. *Ballote*, *Leontopetalon*,
" and *Siliquaſtrum*, are nauſeous.‡" He does not here act the part of a Critic in the common way. Greek and Latin appellations ſeem as it were barbarous to him; and inſtead of Ballote and Leontopetalon, which occur in *Dioſcorides* and *Pliny*, he writes Ballota and Leontice; and Siliquaſtrum the Plinian name, he changes into Cercis; while the Leontice is the Cacalia, and the Cercis a ſpecies of the Poplar. He certainly with a better excuſe might have called the *Clitoria*, *Cynomorium*, *Lycoperdon*, *Onopordum*, &c. nauſeous. [See what he writes concerning taking the ſimilitude of the ſpecific name, in *Phil. Bot. p.* 234].

68. 4*thly*, " The generical names made up of
" two whole and diſtinct words, ſhould be ex-
" pelled

* *Crit. Bot. p.* 134.

† *Vid. Fund. Bot.* § 240.

‡ *Crit. Bot. p.* 134.

" pelled out of the Republic of Botany," Fund. Bot. § 221 *. Therefore *Rosmarinus*, *Staphisagria*, *Centaurium majus et minus*, *Jovis Barba*, *Fœnum græcum*, *Sempervivum*, and the like, must be banished. However, from favour, *he says* †, " We have admitted some Latin names, yet they " are not for this reason to be henceforth imi- " tated; as Cornucopia, Rosmarinus, Semper- " vivum, and Sanguisorba." But he passes an irreversible sentence against the Bella donna T. (it is written by *Tournefort* Belladona in one word), Centaurium majus, Dens Leonis, &c. ‡. He gives this reason for it ||. " The number of " generical names is already large enough, and " indeed sufficient for any weak memory to re- " tain, so that it is needless to multiply existences " without any necessity. What need, I pray, is " there of two words, when one is sufficient? " Good sense owns, that it is foolish to do that " by many things, which can be done as well by " fewer; and here therefore we ought to follow " this dictate. The latter word is with equal " difficulty inscribed on the table of the memory " as the former; *Donna*, as *Bella*; *Idæa*, as *Vitis*, " &c." Where Belladona, Bursapastoris, Centaurium minus, Dens Leonis, Fœnu-græcum, Lilium convallium, and twenty others used by *Tournefort*, are called *unworthy* names, which are for most part officinal, and for that reason are more necessarily and more easily to be inscribed on the table of

* *Vid.* & § 222.—236.
† *Phil. Bot. p.* 161.
‡ *Phil. Bot. p.* 160.
|| *Crit. Bot. p.* 23.

of the memory, than his feigned ones, as Atropa, (from "Atropos, one of the furies," H. Cliff. p. 57 *. Phil. Bot. p. 171.); Leontodon,, which ſhakes one diſagreeably; Convallaria, an adjective, &c.: Who therefore multiplies exiſtences without neceſſity, *Tournefort*, or *Linnæus*?

69. In ſhort, whoever diligently conſiders what this celebrated author † delivers concerning changing the generical names of plants, he will eaſily ſee that he advances with a full pace towards an intire innovation of the Botanical Science. For, there is no medicinal name of a plant, whether it be Greek or Latin, but may be condemned with an equal right, or changed, as being *barbarous*, *compounded*, *diminutive*, *of difficult pronunciation*, *of a mongrel or mixed nature*, *unworthy*, *pathological*, or *not good* in many other reſpects, and ſome are changed by him, of which I have only given ſpecimens. But, if this be done, there will be an end of the materia medica of our predeceſſors; for, all things muſt be neceſſarily diſordered by a confuſion of names. Such beginnings ſhould be oppoſed.

§ XVIII.

70. Among the other extraordinary deſerts of the moſt famous *Linnæus*, celebrated by Mr. *Peter Loſling* ‡, he boaſts much of the vague terms being

* *C. Linnæi Hortus Cliffortianus. Amſtelædami* 1737. *in folio.*

† *Fund. Bot.* § 220. *ad* 250. *and elſewhere.*

‡ *Amœn. Acad.* 2. *p.* 183.

ing tyed down to their proper ſeats, and the new ones introduced by him. Among the vague terms, I find *Scapus*; but, what is Scapus? "It is a "kind of a trunk, and either naked, or covered "with leaves," Fund. Bot. § 82. edit. 1. Yet, "*Scapus* with me is a kind of a trunk, which "riſes from the root, and ſupports the fructifica- "tions alone, without branches or leaves (except "thoſe placed at its root)," Fl. Lap. p. 8. * "What I call a ſtalk, the moſt famous *Linnæus* "names *a Trunk*; of which there are three dif- "ferent ſorts: 1. *A Stalk*. 2. Culmus, or the "ſtalk of corn from the root to the ear. 3. Scapus, "a kind of a trunk, which riſes from the root, and "ſupports the fructification alone without branches "and leaves." *Geſn.* Diſſert. p. 67. It is thus explained with perſpicuity by both; but how theſe explications agree with the Fundamenta Botanica before cited, I do not ſee from both: eſpecially ſince we have the Anchuſa ſcapis diphyllis, H. Cliff. 47.; Hemerocallis ſcapo *ramoſo*, corollis monopetalis, H. Upſal. p. 88. †; and Tulipa ſcapo *tryphyllo*, foliis ovato lanceolatis, ibid. p. 82. Theſe things do not well cohere.

The opinion is therefore to be changed; and Scapus is no longer to be called a kind of a trunk, but a *fulcrum*, or prop. For, in the Fund. Bot. edit. *Pariſiis*, in 1744. § 82. "*A Trunk* is a root "above the earth; and it is of two ſorts, *Caulis*,

"or

* C. *Linnæi Flora Lapponica. Amſtelædami* 1737. *in 8vo.*

† C. *Linnæi Hortus Upſalienſis. Amſtelædami* 1748. *in 8vo.*

" or a Stem, and *Culmus*." And below. § 84. " The *Fulcra*, or props of plants are nine, Bractea, Cirrus, Spina, Aculeus, Petiolus, Pedunculus, *Scapus*, Stipula, and Glandula.——The " *Scapus* bears the fructification, and grows from " the root (not from the trunk)." But thus, the Culmus will likewise be a prop; and why not a Trunk? since it is only a root above the earth, and sustains and bears the fructifications. Yet, neither do these things still please.

Hence, in the Phil. Bot. p. 39. " *A Trunk* brings " forth the leaves and fructification; its species " are six; Caulis, Culmus, *Scapus*, Pedunculus, " Petiolus, Frons, and Stipes; but Ramus is a " part of it;" and below, p. 40. " *Scapus*, is an " universal Trunk, which elevates the fructifica- " tion and not the leaves; as in the *Narcissus*, " *Pyrola*, *Convallaria* and *Hyacinthus*." But then, what must be said of the *Hemerocallis* and *Tulip* above mentioned? yea, of the *Convallaria* foliis alternis, pedunculis axillaribus unifloris, Lin. M. M. p. 56.* However, the *Scapus* is thus excluded out of the number of Fulcra or props. And in Phil. Bot. p. 50. " *Fulcra*, *he says*, are the props " of a plant, for its more commodious support; " to-day they are reckoned seven in number; " Stipula, Bractea, Spina, Aculeus, Cirrus, Glan- " dula, and Pilus." But yesterday they were reckoned nine in number, (to wit, in the Fundamenta Botanica, published in 1744); and three days ago, (to wit, in the Fund. Bot. published in 1736), only six; and who knows how many there

* C. *Linnæi Materiæ Medicæ liber* I. *de plantis. Amstelædami* 1748. *in* 8vo.

there will be to-morrow? Moreover, how fitly, and with what elegant Latinity are leaves to be called trunks; trunks, roots, &c.? Therefore the feat to which the *Scapus* is tyed down is unstable enough; which is likewise true of some other terms.

71. "*A Berry*, with *Gesner* *, is the pericar-
" pium, whose seeds are lodged in a soft pulp;
" and these are either fixed to the pulp, as
" in the *Strawberry*; or they are covered with
" the substance of the pulp, as in the Berries of
" Grapes." But *Linnæus* † says, the Strawberry has no pericarpium; and the Xanthium ‡ has a dry pericarpium. "*A Berry* ||, is the Peri-
" carpium stuffed, without a cavity, and besides
" it contains naked seeds." But the Pericarpium of the Capsicum is a berry without pulp, bilocular, and *hollow*, according to the Gen. plant. p. 84. Yea there, p. 460. the Pericarpium of the Wall-nut Tree is a dry *Berry*, and the *Seed* a Nut; and therefore it should be called *Drupa*, (or rather Druppa), since "*Drupa* is the pericarpium stuffed,
" without a cavity, and contains a nut," p. 53. How manifold is a berry, since the Pericarpium of the Rhus, Solanum, Cyclamen, Mespilus, Aurantium, Ananas, &c. is thus named?

72. "*A Strobilus*, says *Gesner* ||||, is a fruit for-
" med of scales laid one under another like tiles

* *Dissert. p.* 101.
† *Gen. pl. p.* 220.
‡ *p.* 452.
|| *Phil. Bot. p.* 53.
|||| *Dissert. p.* 101.

" on the roof of a houſe, in whoſe ſinuſes or an-
" gles ſeeds are lodged." But, with *Linnæus* *, *A Strobilus* is a Pericarpium formed of an *Amentum*. And " an Amentum † is a calyx formed of " a common chaffy and bud-like receptacle." Yet, in the characters of his Gen. Plantarum, I do not find a Strobilus repreſented as a Pericarpium, except in the Magnolia alone, where there is no *Amentum*, but the calyx is a Perianthium with three leaves, to which nine ſtamina belong, and the pericarpium is an oval *Strobilus*: while the Abies, Alnus, Betula, Carpinus, Cupreſſus, Larix, Lupulus, and Tulipifera, have no pericarpium. This term occurs, but very ſeldom, in the ſpecific denominations; for I have only obſerved it thrice in the H. Cliff.; to wit, Carpinus ſquamis ſtrobilorum planis; & Carpinus ſquamis ſtrobilorum inflatis ‡, & Thuja ſtrobilis lævibus, ſquamis obtuſis ||.

A Capſula, with *Geſner* ||||, is a membranous and roundiſh Pericarpium, as in the Auricula Urſi. But, with *Linnæus* ‡‡, it is a hollow Pericarpium, gaping determinately. Yet, the Pericarpium of the *Epilobium* ††, " is a very long, cylindrical, " ſtriated, quadrilocular, and four-valved *Capſula*:" neither roundiſh, nor hollow, nor gaping determinately, but through its whole length. How perſpicuouſly

* *Phil. Bot. p.* 53.
† *Ibid. p.* 52.
‡ *p.* 447.
|| *p.* 449.
|||| *p.* 101.
‡‡ *Phil. Bot. p.* 53.
†† *Gen. pl. p.* 162.

perſpicuouſly *are the botanical Elements of* Linnæus *explained, by* Geſner, *or* Linnæus *himſelf!* It is aſtoniſhing that ſuch things ſhould pleaſe Botaniſts!

73. " From the characters of the genera of the " celebrated *Linnæus*, ſays Mr. *Loſling* *, which " are delineated to the life, and according to all " the parts of the fructification, almoſt all the Bo- " taniſts of this day have formed new methods for " themſelves; which indeed is now as eaſy to be " done by every one, as it was difficult and ardu- " ous before him. For, he has not only tyed down " many vague terms to their proper ſeats; but " likewiſe has introduced evidently new parts and " new terms, as the *Nectarium*, *Drupa*, *Fulcrum*, " &c. which were not mentioned before him, " though the Botaniſts of our day glory in them: " Who is there deſtitute of them, that can at this " day give a perfect deſcription of a plant?" Thus *Linnæus*'s ſcholar, or *Linnæus* himſelf.

But, with the author's leave, I muſt be of a very different opinion. For, it is not only, not leſs injurious to the ſtudy of Botany, to contrive new methods without neceſſity, than to invent names and uſeleſs terms; and it is likewiſe as difficult, yea, more difficult, from thoſe characters, howſoever delineated to the life, to form a new and at the ſame time an uſeful method, as it was before him.

74. For, concerning the characters of the genera, three things are principally to be obſerved. 1ſt, That the characteriſtic marks of the genera

* *Amæn. Acad. p.* 183.

ought not to be multiplied without neceſſity; nor more of them, than is requiſite to determine the genus with certainty, to be heaped together; leſt, to wit, the memory be too much burthened, and inſtead of characteriſtic ſigns we ſeem to give a deſcription of the plant. 2dly, That the characteriſtic marks, in all the ſpecies of the ſame genus, ſhould be exactly alike; and thoſe parts of the fructification, in which all the ſpecies do not agree, muſt be omitted. 3dly, That they ought to be very obvious, manifeſt, and ſufficiently obſervable by every one. For, ſince the chief uſe of a method is, to lead the ignorant and learners to the knowledge of plants, by a compend, without tediouſneſs and difficulty, ſuch marks ſhould not be propoſed, as require an attentive and careful ſpectator, ſo that it ſhall thereby be neceſſary for every one to carry a microſcope about with him *.

The moſt famous *Linnæus* remarks †, that *Ray* was wrong in laying down this laſt rule, and adviſes all the parts of the fructification to be examined, even thoſe that eſcape the ſight, though a microſcope ſhould be uſed. Yet, he acknowledges, that no character is infallible, before it is regulated according to all its ſpecies. And, he adds, "The character is made natural by a very "accurate deſcription of the firſt ſpecies of fruc"tification; all the other ſpecies of the genus "muſt

* *Vid. Tournefort, p.* 50. and *Ray's Rules prefixed to his Methodus plantarum emendata et aucta. Londini* 1703. *in* 8*vo.*

† *Phil. Bot. p.* 131.

" muſt be compared with the firſt, and by exclud-
" ing all the marks wherein they differ, at length
" it becomes elaborate *."

75. But, that the *Linnæan* characters are not elaborate, the author confeſſes; ſaying, " A genus
" is rarely to be obſerved, in which ſome part of
" the fructification does not vary," Fund. Bot. § 170. And he adds in Phil. Bot. p. 121. " Un-
" leſs this rule is taken, as many genera would
" be reckoned, as there are ſpecies that exiſt."
But if he had obſerved the firſt rule given above, this rule would have been unneceſſary, and almoſt no variation of the ſpecies would have happened. Of which matter he himſelf now ſeems to be conſcious: for, in the preface to his Syſtema Naturæ, he ſays, " I have aſſigned new, and thoſe
" very compendious *characters* to plants, when I
" could not always find out ſuch as are eſſential,
" that learners might the more eaſily diſtinguiſh
" and know them aſunder." And for this reaſon, this contracted ſyſtem is much more uſeful than thoſe things which the ſexual method brings to its aſſiſtance, than the diffuſe characters whereof Mr. *Loſling* boaſts. For, that unhappy method confounds every thing.

76. Becauſe, the number of the ſtamina, being very various, it renders the ſearching out of the genera exceedingly difficult, yea, and often impoſſible, by a learner. Who, I pray, looking at the Tamariſcus Germanica, B. P. that was unknown to him, which has ten ſtamina, would conſult the fifth

* *Id. Ibid.*

fifth claſs, or Pentandria, for its character? Who would ſeek the character of the Valeriana rubra Dod. in the third claſs, or Triandria? Of the Gratiola centauroides B. P. in the Diandria? Or, of the Rhodia radix B. P. in the twenty-third claſs, called Polygamia, betwixt the Fraxinus and Empetrum; or would ſeparate it from the Anacampſeros, or Sedum, of *Linnæus*; or the Sedum itſelf from the Sempervivum? And ſo of innumerable others. Hence it evidently appears, that the genera, all of them at leaſt, are not natural; or, if they are to be called natural, as the celebrated *Linnæus* often aſſerts *, an agreement in all the parts of the fructification is not required to conſtitute them, and they are wrongly conſtituted by it. But, why the genera are to be called natural, rather than claſſes and orders, I do not as yet ſee.

§ XIX.

77. If the celebrated *Linnæus* had ſpent a tenth part of that time which he has beſtowed on the ſpecious contrivance of ſyſtems, new names, &c. in amending the method of *Moriſon*, *Ray*, or *Rivinus*, he would have done much more ſervice to this beneficial art. For, the invention of the ſexual ſyſtem ſeems ſcarce worthy of the famous *Burckhard*; or, it is ſcarce worth while for the celebrated *Heiſter* to contend about it, in his learned preface to *Burckhard*'s epiſtle: wherein he treats of the inventors of a method of plants, ſhews that the author of the epiſtle is the inventor *of the ſexual*

* *Vid. Gen. pl. præf. p.* 2. *Syſt. nat. p.* 216. *Fund. Bot.* § 160.

sexual method *, and celebrates his merit together with that of *Joach. Camerarius*, and *Joach. Jungius*, which has been hitherto commonly neglected; and suggests some other things to illustrate the history of the Botanical Science.

In § 52. he speaks thus: "And especially after "*Jungius*, *Malpighius*, and likewise *Menzelius*, "and others, were engaged in making farther "inquiries concerning the sexes of plants; but "afterwards in the cleareſt manner, of all others, "*Rud. Joach. Camerarius*, (in 1694); also *Burck-* "*hardus*, (in 1702); *Waldschmidius*, (in 1705); "*Gakenholzius*, (in 1706); and at last, a long time "after these, *Vaillantius*, a Frenchman, (in 1717), "who, in writing and speaking of them, intirely "suppresses the names of these his most excellent "predecessors; but for what reason, I know not; "as if this doctrine was something quite new, and "not heard of before." See his Preface, p. 70. But here the good *Homer* nods, or is mistaken.

78. For, 1st, He himself has suppressed, intirely without reason, the name of *Grew*, who in the year 1676, and first of all, delivered the late opinion concerning the sexes of plants, and explained it very distinctly; and likewise *Ray*'s name, who was the first, as far as I know, that embraced *Grew*'s opinion. While also *Burckhard* himself writes †, "I have determined now to consider, "whether

* *Jo. Hen. Eurckhard Epistola ad G. G. Leibnitium, cum L. Heisteri præfatione. Helmstadii* 1750. *in 8vo. Vid. præf. p.* 76. 84.

† *Epist. p.* 146.

" whether the orders of plants may be modelled " by thoſe parts, *which from their office I am about* " *to call genital*:" though the ſame things had been ſaid long before by *Grew*.

2dly, *Malpighius* not only does not admit the diſtinction of ſexes; but alſo ſeems to believe that the petala and ſtamina are as it were emunctories, and only employed in the purification of a diſagreeable humour *: nor does *Jungius* allow it, unleſs *Camerarius* is miſtaken, who writes thus: " Both " theſe hiſtories of generation have undergone al- " moſt the ſame fate, and have been ſucceſſively " and gradually improved by the moderns, ſince " what *Harvey*, *Stena*, and *Swammerdam*, had ob- " ſerved in animals, *Grew* and others have at the " ſame time taken notice of in plants. What " therefore forbids us in any meaſure to aſcribe " properly to plants a male and female, and con- " ſequently a difference of ſex, *though Jungius is* " *againſt it*; and the rather, becauſe in the mo- " numents of the ancients, to wit, in the writings " of *Ariſtotle* and *Theophraſtus*, the author has ob- " ſerved the traces of this opinion, as in his ſecond " appendix he particularly informs us." Thus *Camerarius*, as he is quoted by *Valentinus* †.

3dly, *Camerarius* himſelf doubts of this doctrine; yea, refutes it by an experiment: for, he ſaw many fruitful little grains and ſeeds, obtained from ſolitary female plants of the Mercurialis, Spinachia and Cannabis, nurſed in places where they had no communication with, or contagion from, a neighbouring male. And therefore, though it were

* *Vid. p.* 70.

† *l. c.* No. 41.

were found by experiments, that, " if the An-
" theræ, as ſoon as flowers are opened, be cut off,
" that theſe flowers do not produce fruit, or
" ſeeds *;" (which, however, is not true); it by no means thence follows, that theſe are really the genital organs; as we have already ſhewn (No. 43).

§ XX.

79. Yet, the moſt famous *Linnæus* deſerves the higheſt praiſes, principally on a double account. 1ſt, Becauſe he diſtinguiſhes the ſpecies of plants from their varieties, more accurately than any other Botaniſt. And, 2dly, Becauſe he takes the ſpecific names, not from the accidents of place, time, inventor, uſe, &c. as is cuſtomary, but from the eſſential parts of plants, in which thoſe of the ſame genus really differ from one another. " I
" have placed, *he ſays* †, the varieties under each
" ſpecies, though it is a moſt audacious attempt,
" ſince varieties, by my cotemporaries, not to ſay
" all, ſecurely enjoy the privilege of ſpecies ‡."

Care however ſhould be taken that we fall not into the oppoſite extream, ſo that ſpecies are taken for varieties: This Scylla is not leſs to be avoided than Charybdis. Whether therefore are all the Pæoniæ of *Tournefort* to be reckoned varieties; the Lapathum folio acuto rubente B. P. & Lapathum aquaticum, folio cubitali ejuſdem; Convolvulus

* *Vid. Heiſt. præf. p.* 72.
† *Præf in H. Cliff.*
‡ *Vid. Fund. Bot.* § 256. *ad* 305.

major albus B. P. & Scammonia Syriaca ejuſdem ; Rhabarbarum T. & Lapathum folio rotundo alpinum J. B. ; Sorbus ſativa B. P. & Sorbus aucuparia J. B. ; Euonymus vulgaris B. P. & Euonymus latifolius ejuſdem ; Ceraſus ſylveſtris, fructu nigro J. B. & Ceraſa acida nigricantia ſolidiora tardius matureſcentia ejuſdem ; and ſome others, as the illuſtrious author of the H. Cliff. would have it, is deſervedly to be doubted. For, I always eſteemed every diverſity in plants, which is very remarkable, if it be alſo ſtable, or which neither ariſes from culture, nor is mutable, to be a ſpecific difference ; as the famous *Ray* teaches. " No more " certain mark of ſpecific (as they call it) diſtinc- " tion, *he ſays*, hath occurred to me, though I " ſought long for it, than a diſtinct propagation " from the ſeed. Therefore, whatſoever diffe- " rences ariſe from the ſeed of the ſame plant, " are accidental, and not ſpecific. But ſuch as " never come forth from the ſeed of the ſame " ſpecies, are then to be accounted ſpecific *." And yet he himſelf frequently deviates from this precept ; and *Tournefort* plainly acknowledges, that he little regards, whether they are varieties, or ſpecies, which he mentions, if they do but differ, in ſome circumſtances natural to them, which are obvious to the ſenſes.

So. " I have every where, ſays *Linnæus* †, " given to plants new ſpecific names, becauſe " worthy old ones are ſcarce to be found any " where. I did not ſet out in this enterpriſe, " from

* *Vid. Raii Hiſt. pl. p.* 40.
† *l. c.*

" from a belief that my own ſpecific names are as " excellent as the others, but becauſe far ſhorter, " more certain, and therefore more proper ones, " may be contrived: for, I ought rather to try a " doubtful than no remedy of botany, ſince its " proſperity is only to be hoped for in this way." And elſewhere *, " The ſpecific name, at the " firſt ſight, will diſcover its own plant; becauſe " it contains the difference from all that are of the " ſame genus which is inſcribed on the plant it- " ſelf." But to expreſs this difference elegantly and briefly in words, is an arduous enough undertaking, and actually worthy of *Linnæus*.

And caution is likewiſe to be uſed here, when the ſpecies of any genus are numerous, leſt deſcriptions be given inſtead of names. Hence *Linnæus* ſays, " The number of words which are " uſed in the difference, never admits of more " than twelve words: for, as the generical names " will conſiſt of twelve letters at the moſt, ſo like- " wiſe ſhould the difference conſiſt of twelve words, " that their limits may be at length eſtabliſhed." Then he endeavours to ſhew by a calculation, (which I do not underſtand), that though a genus contains a hundred ſpecies, which number he knows no genus to have reached, that twelve words at the moſt are ſcarce ever neceſſary, for the difference of the genus which comprehends a hundred ſpecies. He adds, " The very long ſpecific names *of the* " *antients* are therefore to be dreaded, which " compriſe deſcriptions inſtead of differences;" and cites three examples, two out of *Plukenet*,

* *Fund. Bot.* § 258.

and one out of *Breynius*, which moderns are antient enough *.

81. But that twelve words are required for the ſpecific difference, when the number of plants of the ſame genus is much leſs than a hundred, will appear by an example. The *Cataputia* of the ſhops is a ſpecies of the *Tithymalus* with *Moriſon*, and from thence with all ſyſtematic writers, before the illuſtrious *Linnæus*, who prefers to Tithymalus, or Tithymallus, both uſed by *Hippocrates* himſelf, Euphorbia, a much more modern name. This Cataputia is the *Tithymalus* latifolius, Cataputia dictus, H. L. 599. †, & T. 86. *Euphorbia* inermis, foliis oppoſitis lanceolatis, umbella univerſali trifida polyphylla, partialibus triphyllis, reliquis diphyllis, H. Cliff. 198. Or the *Euphorbia* inermis, foliis oppoſitis lanceolatis, umbella univerſali quadrifida, tetraphylla, (*ulterioribus dichotomis*), H. Upſal. 140. reliquis dichotomis, Lin. M. M. 90. And therefore, in the one there are thirteen, and in the other eleven words; or rather eighteen ſimple words in the former, and fifteen in the latter: though the author does not admit forty ſpecies of the Euphorbia. Theſe are therefore very long names; nor are the *Plukenetian* above-mentioned much to be dreaded, though they are leſs accurate than the *Linnæan*: yet, it muſt be a ſtrong memory that can retain them.

Hence he now admits ſufficiently ſhort ſpecific names, which he calls *Trivial*. "*The legitimate* "ſpecific

* *Phil. Bot. p.* 228.

† *Pauli Hermanni Hortus Academicus Lugduno-Batavus. Lugd. Bat.* 1687. *in* 8vo.

" ſpecific name, diſtinguiſhes a plant from all thoſe " of the ſame genus; but the *Trivial* name is " hitherto ſubject to no laws.——The ſpecific " name is therefore the eſſential difference. *The* " *trivial names* may perhaps be allowed; in the " manner in which I have uſed them in the *Panis* " *Suecicus*, if they only conſiſt of one word, and " are every where freely choſen. I am convinced " of it, chiefly for this reaſon, that the difference " often becomes long, ſo that it cannot be every " where conveniently uſed; and alſo it is liable to " be changed, when new ſpecies are diſcovered *." He has likewiſe made uſe of them in the *Gemmæ Arborum*†; yet they do not always conſiſt of one word, but often of two, and ſometimes of three words, without regarding in the leaſt the eſſential difference.

Thus the *Tithymalus* helioſcopius, B. P. 291. is the *Euphorbia* inermis, foliis ſubrotundis crenatis, umbella univerſa multifida polyphylla, partialibus trifidis, propriis tryphyllis, H. Cliff. 198. Or the *Euphorbia* foliis crenatis, umbella univerſali quinquefida pentaphylla, partialibus trifidis, propriis triphyllis, H. Cliff. Fl. Suec. 159. ‡ and the *Euphorbia Soliſequia*, Pan. Suec. Amæn. Acad. 2. 249. The *Gramen* caninum arvenſe, B. P. 1. is the *Triticum* radice repente, foliis viridibus, H. Cliff. 24. and the *Triticum rad. officinarum*, P. S. Amæn. Acad. 240. The *Salix* pumila folio rotundo, J. B. 1. 2. 217. is the *Salix* foliis integris glabris ovatis, ſubtus reticulatis, Fl. Suec. 292. and the *Salix folio ſubtus reticulato*, P. S. Amæn. Acad. 2. 260.

The

* *Phil. Bot. p.* 202.

† *Amæn. Acad.* 182—223.

‡ *C. Linnæi Flora Suecica. Lugd. Bat.* 1745. *in* 8vo.

The *Leonicera*, *Xyloſteum*, Fl. Suec. G. A. Amæn. Acad. 2. 202. is the *Leonicera* pedunculis biſloris, baccis diſtinctis, foliis integerrimis, Fl. Suec. 67. The *Lonicera*, *Periclymenum Germanicum*, Fl. Suec. G. A. Amæn. Acad. 2. 203. is the *Leonicera* floribus capitatis terminatricibus, foliis omnibus diſtinctis, Fl. Suec. 67. The *Acer folio ſubtus glauco*, H. Upſal. G. A. Amæn. Acad. 204. is the *Acer foliis* quinquelobis acuminatis acute ſerratis, petiolis teretibus, H. Upſal. 94. and ſo of the reſt. This is a recent, and very rich mine, out of which new names are to be dug at pleaſure.

Yet, it is moſt certain, that *Linnæus's legitimate ſpecific names* are of ſo great uſe in Botany, that they often ſhew a more certain and perſpicuous difference of the ſpecies, than can be eaſily gathered from the prolix deſcriptions of ſome writers. Neither are the *trivial* names to be deſpiſed as uſeleſs, if they are only taken from the legitimate ſpecific, or ſynonymous marks; ſince thoſe perhaps alone are to be properly called *names*, and which ſhould not be multiplied without neceſſity.

§ XXI.

82. Thoſe ſpecies of plants that agree in moſt parts of the fructification, eſpecially in the flower and fruit, are judged to be of the ſame genus; as the great *Conradus Geſnerus* firſt taught, who was born at *Zurich*, in 1516; and died there of the plague, in the year 1565, in the 49th year of his age, "while he was laying the foundation of Botany,

" tany, which afterwards laboured under many " imperfections, becauſe thoſe that lived after him, " did not follow his footſteps *."

Geſner's Botanical works, which for a long time have been lamented as loſt, ſtill exiſt in manuſcript, and perhaps at length will ſee the light. For, *Joh. Geor. Volckamerus*, in his explications of the abbreviations in the Flora Noribergenſis †, ſpeaks thus: " The author of this Catalogue has " in his poſſeſſion figures of both alpine and exo- " tic plants, which were painted to the life, and briefly deſcrib'd by *Conradus Geſnerus*." There is likewiſe in this manuſcript, " *Conradus Geſnerus*'s " hiſtory of plants, with their virtues," as a diſtinct work. We are alſo informed by the illuſtrious *Heiſter* in his above-mentioned preface ‡, that *Joachimus Camerarius*, a Phyſician and Botaniſt of Norimbergh, bought that botanical treaſure, not long after *Geſner*'s death, of his heir *Caſpar Wolfius*, with a deſign to publiſh it: that from *Camerarius* it afterwards came into the hands of the *Volckamer's*, where it laid neglected for a very long time, and from them at length, in the year 1744, when the laſt *Volckamer* died, to the illuſtrious *Trew*, likewiſe a moſt excellent Botaniſt of Norimbergh.

83. But the right way of conſtituting the genera, " Perhaps would have ſtill lain in darkneſs, " unleſs *Robert Moriſon, of Aberdeen in Scotland*, " had

* *Vid. Tournef. p.* 50. 53.

† *Johannis Georgii Volckameri Flora Noribergenſis. Noribergæ* 1700. *in* 4to.

‡ *p.* 11.

" had reformed and reſtored it, which was as it " were alienated by Herbariſts, and firſt applied " it to conſtant uſe; for which ſervice high en- " comiums ought to be conferred on him; but he " would have merited far greater, if he had ab- " ſtained from ſelf-praiſe *." *Robert Moriſon* was born at *Aberdeen* in the year 1620, and died at *London* in 1683. He was without doubt an eminent Botaniſt, ſeeing he was much celebrated even by his cotemporaries. " *Robert Moriſon* an Engliſh- " man, (ſays *Mentzelius*), a Phyſician, and the " moſt diligent Botaniſt of our ſeventeenth centu- " ry. Beſides a new diſtribution of plants into " certain claſſes, &c. he has wrote an Hortus Re- " gius Bleſenſis, Præludia Botanica, &c." *Vid. Ment. Ind. Elench. auctorum* †; where there is no mention at all made of *Jungius*. " In the liſts of " names, (ſays the famous *Herman* ‡), I have fol- " lowed the guidance of the principal Botanical " writers of our age; *Caſpar* and *John Bauhine*, " as alſo *Robert Moriſon*, and others, in whom we " may find plants that are omitted by the already " commended authors." And below, " *Moriſon* " will principally inſtruct you in the character " of a plant, *Caſpar Bauhine* in the ſynonymous " names, &c." And in another place ||, " Mr. " *Robert Moriſon*, who, while he lived, was by " far

* *Tournef. p.* 53.

† *Index Nominum plantarum multilinguis, opera Chriſtiani Mentzelii. Berolini* 1682. *in folio. Ejuſdem Pugilus rariorum plantarum ad calcem Indicis editur.*

‡ *Præf. in H. L. Bat.*

|| *H. L. Bat. p.* 164.

" far the moſt famous Profeſſor of Botany in the " univerſity of *Oxford*, ſent me this Cnicus, which " was gathered about Tangier." Neither do I here find *Jungius*'s name, nor in *Volckamer*, *Tournefort*, or *Boerhaave*.

84. I am ſorry indeed, that the famous *Heiſter* thinks otherwiſe of *Moriſon*. For, he writes thus in the preface already commended, p. 36. " Moſt " writers who have treated of the riſe and pro- " greſs of Botany, when they ſpeak of *Cæſalpinus*, " or even of *Columna*, complain, that for a very " long time after him, the Botanical ſcience lay " as it were unimproved and contemned, and take " a leap from *Cæſalpinus*, or from this *Columna*, " directly to *Moriſon* and *Ray*, who were both " Britons, lived at the ſame time in England, and " publiſhed writings concerning Botanical method " almoſt towards the end of the laſt century, and " have attributed eſpecially to *Moriſon* almoſt all " the glory of inventing a method: but yet, as is " to be here remarked, *Moriſon* in his firſt Bota- " nical writing, which he intitled *Præludia Bo-* " *tanica*, and publiſhed at *London* in 1669, in 8*vo*, " has only recounted in alphabetical order the " plants of the Garden at Blois, which *Gaſton* " *Duke of Orleans*, a little before this time, cul- " tivated in France, and of which for ſome years " he was Overſeer; and likewiſe the miſtakes, " which he believed he had firſt obſerved in the " writings of *Caſpar* and *John Bauhine*; (yet our " *Jungius* had already before him remarked a great " many of them). But in the preface of his book, " *Moriſon* there boaſts very much, that he firſt

" found out a method of plants, which no one had " till then thought of; yet he has not even di- " vulged it in this treatise." And below, p. 40. relating what *Jungius* has done in his Doxoscopiæ, " Part 2. § 3. (*he says*) in the proæmium, he be- " gins thus: *Unless plants are reduced into certain* " *genera and species by a constant scheme, and not* " *according to the fancy of this or the other per-* " *son, the study of the knowledge of vegetables will* " *be rendered as it were infinite. For, the human* " *understanding shuns infinity, because infinite things* " *cannot pass through it. But an order of classes,* " *genera, and species, puts an end to infinity* *. " From which it appears, that this excellent man " here pointed out the true and principal founda- " tion of Botanic method; *and that* afterwards *all* " *methodical Botanists followed his opinion.*" He gives many other instances of this, and honours him with high commendations; to detract from which I have no inclination.

85. Yet, I may observe by the by, that the most famous *Heister* adduces no example of the character even of one genus being constituted by *Jungius*, or of an ennumeration of its species: while what he writes of plants in general, of flowers, or concerning the use of method, occur much more clearly in *Cæsalpinus*; from whom, as far down as *Morison*, there is a total silence concerning the constitution of a method of plants. But that *Morison* was assisted by *Jungius*'s observations,

* See *what are cited out of* Cæsalpinus, *infra*, No. 86.

vations, or borrowed any thing from him, is very improbable. For, the edition of the *Hortus Blesensis* in 1669 is the third edition, the second having come out at *Paris* in 1655. In the preface to the third edition, he says, "I have now in my custody my "new method, which ranks all the classes of vege- "tables in tables according to their kindred; but "I cannot spare money wherewith to defray the ex- "pence of the work of designers and engravers." And in the preface to his dialogue, writing to Mr. *John Fell*, "These my Præludia Botanica, pave "the way to my new method, of which I have "shewn you the copy." And in the dedication of the Hallucinationes, "*Gaston Duke of Orleans in* "*France*, desired me to take notice of the over- "sights of *Caspar Bauhine*, who was superior to all "the Botanists that wrote before him; and com- "manded me to do it, while I dwelt at Blois, "where I lived for some years." He was over- seer of the garden at Blois, from the year 1650 to 1660, when the Duke died. Mr. *Ray* observes *, that specimens of *Morison*'s method were published before the year 1667. But the Isagoge phytoscopica of *Joachimus Jungius*, was not printed at *Hamburgh* before the year 1678, as Mess. *Heister*, *Seguierius*, and *Linnæus*, have it; or 1679, as it is in *Ray*'s Hist. plant. and *Tournefort*'s Inst. edit. 1719. "From whence it might, (says the most "famous *Heister*, p. 39.) easily come into Eng- "land to *Morison* and *Ray*, as also it was undoubt- "edly brought thither, since *Ray* hath often com- "mended both him and his books." *Ray* indeed,

* *Præf. in meth. emend.*

in the first volume of his Hist. pl. published in 1686, often commends *Jungius*, and sometimes corrects him; but makes no mention of his Doxoscopia physica. It does not therefore appear that *Morison* ever saw any of *Jungius*'s books.

§ XXII.

86. Now, after the genera are carefully established, another point of botanic doctrine, on which great stress is to be laid, consists in their disposition; which ought to be so ordered, as may conduce most towards conveying a plainer and shorter knowledge of plants. This will be easily obtained, if the genera are distributed into some classes in such a manner, as that by their aid the names of plants are marked out immediately, and without an instructor. But a number of genera accumulated into one regular series, is denominated *a class*; which genera have some one common and so proper a mark, that they differ intirely from all the other genera of plants. And indeed, *Andreas Cæsalpinus*, of *Arezzo*, who was born in the year 1519, and died at *Rome* in 1603, discussed this part of Botany with the greatest exactness, before it was attempted by any one; and he alone amongst Botanists has left us a way of ranging plants by classes, worthy of a philosopher *.

"In this immense multitude of plants, (says "*Cæsalpinus*), that I see is wanted which is wont "to be much sought for in any disordered army "of

* *Vid. Tournef. p.* 51. & 66.

" of ſoldiers whatſoever: for, unleſs they are " brought into inferior ranks, and, like the front " of an encampment, diſtributed into their own " companies, all things muſt be neceſſarily diſ- " turbed with tumult and uncertainty. This we " alſo now find to happen very much in a conſi- " derable number of plants: becauſe, when the " judgment is overthrown by an irregular multi- " tude, inextricable errors, and moroſe alterca- " tions, generally ariſe: for, while the proper " genus is unknown, no deſcription, though ac- " curately given, demonſtrates a plant with cer- " tainty, but for moſt part is fallacious. There- " fore, while the genera are confuſed, all things " muſt be neceſſarily confounded, &c." *Vid. Cæſalp. l. 1. præf.*

87. " Though the ſyſtematic diſtribution of " plants, was long ago diſcovered and promul- " gated to all the world by *Cæſalpinus*, yet it re- " mained, for near a whole century, unmeddled " with and neglected, even till, by good luck, it " was firſt revived by *Moriſon*, who was born to " advance Botany. He does not indeed ſay one " word about *Cæſalpinus*; yet this will not ſeem " wonderful to thoſe, who examine how much " *Moriſon* has deviated from the *Cæſalpinian* laws: " he has certainly departed from thoſe rules, more " than the other ſyſtematic writers who ſucceeded " *Moriſon*, who neither themſelves have ſung his " deſerved praiſes." Thus *Linnæus* *.

88. Here he ſeems to ſhew, that *Ray*, who was highly

* *Syſt. plant. p.* 33.

highly displeased with *Morison*, treats him rudely after his death, and indeed in an unusual manner. For, in the explication of names in his Hist. Plant. he has these reflections: "*Robert Morison*, as "long as he kept himself within his own bounds, "and was employed in composing Catalogues of "Gardens, searching out the characteristic signs "of the genera, and in detecting and correcting "errors, or (as he loves to speak) blunders in "the disposition of the species of vegetables, he "truly deserved praise. But when he would "please himself too much, and being full of him-"self, would likewise despise *others more learned* "*than himself*, daring to attempt things superior "to his abilities, and to write an universal history "of plants, he neither consulted his own reputa-"tion, nor satisfied the expectations of many "persons."

And in the preface to his Methodus Plantarum emendata & aucta, he writes thus: "In the year "1667, the most reverend Dr. *John Wilkins*, "Bishop of Chester, solicited me strongly, to re-"duce trees and herbs into some method, in "order to complete *the philosophical Tables* for "*an universal character*, (whereof a specimen at "that time came to light); yet in this I was not "at liberty to follow the order of nature, but ob-"liged to distribute both kinds into only three sub-"ordinate kinds; (for, the nature of my design al-"lowed of neither more, nor fewer). Howsoever, "not presuming to deny any thing that so great "a friend requested of me, I executed that work "in a hurry, and almost immediately. Mr. *Ro-"bert Morison*, of *Aberdeen*, in *Scotland*, M. D.

"being

" being highly offended with it, fearing perhaps " leſt thereby his fame and authority ſhould be in " any degree leſſened, of which he had, and not " undeſervedly, gained to himſelf no ſmall ſhare " among Botaniſts, *by publiſhing ſpecimens of his* " *method*, which he boaſted he did not extract " from books, but that he was taught it by nature " herſelf, and taking it ill that I dared to put a " ſickle into his harveſt, he reviled *thoſe Tables* in " an unbecoming manner, while he concealed the " name of the author. Though I ſhould acknow- " ledge that that method was obnoxious to cen- " ſure, and not only imperfect, but in many re- " ſpects *erroneous* and *amiſs*; yet, when I ſaw " myſelf deſpiſed and plainly ridiculed by a man, " who is vain and full of himſelf, not to ſay any " thing more ſevere, or diſquiet the ſoul of the " dead, that I might in ſome meaſure take care of " my own credit, I reſolved to try what I could " do, in digeſting plants, and planning out a me- " thod, by freely following the guidance of na- " ture; and at length, after long and mature de- " liberation, I compiled that diſtribution, from " comparing my own obſervations with thoſe of " others, which I afterwards publiſhed, under the " title of *Methodus plantarum nova*, in the eightieth " and ſecond year of the laſt century." Nor do I know what he could have ſaid more ſevere.

89. Howſoever, the whole cauſe of this ſcold- ing, as far as I can find, was this. In a *Dialogue* betwixt a *Fellow* of the Royal Society and a *Bota- nographer* *, the *Fellow* ſays, " Undoubtedly, I " have

* *Moriſ. Præl. Bot. p.* 476.

" have thought that a generical mark is taken " from the reſemblance of the leaves. The *Botanogr.* " And I have obſerved this in many authors, who wrote ſome years ſince; yea lately, " in a certain book, publiſhed by an author who " is a Fellow of your College, wherein a method " of plants taken from the reſemblance of their " leaves is exhibited, and the claſſes are diſpoſed " in tables. I only found it a confuſed Chaos: I " read therein concerning plants, but I learnt no- " thing; and I will ſhew you its miſtakes and " confuſion at another time, becauſe I muſt not now " digreſs."

90. Though there is no occaſion to vindicate *Moriſon* in the opinion of the learned; yet I ſhall tranſcribe a few things, out of his life and the preface, which are prefixed to the third volume of the Hiſt. Pl. Oxonienſis. " He was a moſt candid " man to ſhew to all, and teach all, his method, " both by his writings and converſation, being " envious of no perſon's fame, while his own was " ſecure, to which he always preferred the public " good. For, *Moriſon*'s reputation is not to be " deſpaired of, as long as *Ray*'s *Synopſis ſtirpium* " *Britannicarum*, or the *Hiſtoria plantarum* of the " ſame author, will be valued by Botaniſts: in " both which there is not a page, filled with " how much ſoever ornament and inſtruction, " where *Moriſon*'s genius does not ſhine." *Vid.* Moriſ. vitæ, p. 4.; and there we have alſo the opinions of *Ammannus*, *Breynius*, *Cupanus*, &c. concerning him.

" In

" In the mean time *Aberdeen*, very luckily, " brought forth *Robert Moriſon*, the unrivalled " chief of all Botanic writers, how many ſoever " they were; to whoſe guidance, unſpeakable " penetration, and moſt ſucceſsful ſtudies, ſtudents " of *Botany* owe more, than to all the labours of " the antients. Every one may be ſpeedily con- " vinced of this, who will carefully conſider his " *animadverſions on John and Caſpar Bauhine in* " *his Præludia Botanica Bleſenſia*, & *Hiſt. Oxoni-* " *enſis*: and, as the moſt famous *Paulus Ammman-* " *nus* juſtly remarks, which I am not aſhamed to " repeat, *in theſe nervous works of* Moriſon, *more* " *luſtre, more truth, and more advantage accruing* " *to lovers of medicine, are contained, than in all* " *the very numerous volumes, which are interſper-* " *ſed with connexions of the antients: let the pri-* " *vate judgment, of every one who is impartial and* " *unprejudiced, be arbitrary.*" Theſe things were ſaid by the moſt famous *Bobart* in the above mentioned preface, about ſix years before the death of *John Ray*. *Moriſon*'s Hiſt. Oxon. is likewiſe much commended by the great *Boerhaave* *. " Theſe " things prove that *Moriſon* (to ſpeak again with " the author of his life) *durſt write the Hiſtoria* " *Oxonienſis, and both conſulted his own reputation,* " *and ſatisfied the expectations of the learned*: al- " though he preſumed to deny it, who owed all " his improvements in Botany principally to *Mo-* " *riſon.*"

* *Ind. alt. pl. præf. p. 17.*

§ XXIII.

91. As I judge that the character of the genera is to be borrowed the moſt conveniently from the fructification, ſo I think that of the claſſes is to be taken the moſt commodiouſly from the flower, in the more perfect plants; in others from the habit, or external facies; but the characteriſtic of the orders, or ſections of the claſſes, from the fruit; as from the moſt eſſential and viſible parts. And this is *Tournefort*'s method *, which is by far the eaſieſt of all others, and the moſt uſeful to learners, as I before obſerved. I confeſs, with the moſt famous author, that it is not finiſhed; nor am I ignorant of what has been animadverted upon it by the learned, as by *Ray*, *Dillenius*, &c. but eſpecially by the moſt famous *Juſſieu*.

92. Yet, I know not, whether by taking out or obliterating the ſpots or imperfections which are obſerved in the *Inſtitutiones rei herbariæ*, their elegance and utility would be much heightened: while a ſyſtem abſolutely perfect, is not to be expected from this age, if it ever be conſummated. In the mean time we enjoy theſe, earneſtly intreating the celebrated and moſt humane Mr. *Bernard* de *Juſſieu*, to put the laſt hand to them, and reſcue Botany from the various difficult trifles and fooleries, with which it is burthened and almoſt oppreſſed.

Thoſe

* *Vid. Inſt. p.* 65. 66. 67.

Thoſe that would be acquainted with what others have done towards compleating a method of plants, may peruſe the authors themſelves; or the celebrated *Carolus Linnæus*'s *claſſes plantarum*, ſeu ſyſtemata plantarum omnia *à fructificatione* deſumpta, quorum xvi. univerſalia, & xiii. partialia, compendioſe propoſita, ſecundum *claſſes*, *ordines*, & nomina *generica*, cum clave cujuſvis methodi, & ſynonymis genericis. Fundamentorum Botanicorum, pars ii. Lugd. Bat. 1738. in 8vo.

§ XXIV.

93. It would take up too much time to expatiate on the uſes of plants. We cannot live without them. For, whatſoever things are neceſſary for food, whatſoever things are eſteemed delicacies, they abundantly ſupply; they not only afford ſuſtinence, but likewiſe cloathing, and medicines, and houſes, and ſhips, and houſhold-furniture, and fuel, and recreations of the ſenſes and mind. But we think it needleſs to dwell on theſe things. *Ray*'s Hiſt. Pl. p. 46. may be conſulted on this head.

94. However, we may remark, with reſpect to their medical uſe, that no method of Botany is of ſo great ſervice towards inveſtigating the virtues of plants, as is pretended by ſome; the firſt of whom was *Cæſalpinus*, who, in the preface to his treatiſe on plants, writes thus. "At length even "the powers, which phyſicians moſt ſeek for as "their properties, are diſcovered from a know-

" ledge of their natures; thoſe that are aſſociated " in the ſame genus, for moſt part poſſeſs ſimilar " powers;" which others fully proſecute; particularly *Frederick Hoffman*, who was Profeſſor of Medicine at *Hall*, in his Diſſertation *concerning a compendious method of ſearching out the virtues of medicinal plants*; and very lately by the moſt famous *Linnæus* in his Fundamenta Botanica and Philoſophia Botanica, from page 278. to 287. Here it is aſſerted, that " Plants which agree in " their *genus*, alſo agree in their virtues; thoſe " that are contained under a natural *order*, likewiſe approach one another in virtues; and ſuch " as agree in a natural *claſs*, alſo in ſome meaſure " agree in their virtues."

95. But it is very well known, that the parts of the ſame ſpecies very often differ widely from each other in virtues. For inſtance, the Root and Leaves of the common Wormwood, common Sorrel, Birthwort, &c. the Bark and Wood of the Cinnamon Tree, Citron Tree, the Tree that yields the Peruvian Bark, &c. the Leaves and Flowers of the white Lily, Jaſmine, Roſes, &c. the Flowers and Fruit of the Sloe Tree, Peach Tree, Pear Tree, &c. the Fruit, Bark, and Kernel of the Anacardium, Wallnut, Almond, &c. What occaſion is there for examples? How much the ſeeds, fruits, and other parts of plants, which are in medicinal uſe, differ, from thoſe parts that are not uſed, in virtues, no one can be ignorant, who knows how to diſtinguiſh betwixt wheat and the chaff ſcattered by the wind.

In

In like manner, the ſpecies, are different in nature, of the ſame genus; whether this be natural or artificial, is of little ſignification. The common Wormwood, and the inſipid Wormwood, are quite different from one another; likewiſe the Succotrine Aloes, and the American Aloes; the Cinnamon, and the Saſſafras; the biting Arſmart, and the mild Arſmart; the leſs Sedum, and the leaſt Sedum; the male Balſam apple, and the wild Cucumber; the common Cucumber, and the Coloquintida; the acrid Ranunculus, and the ſweet Ranunculus; and numberleſs others.

96. Much leſs always do thoſe plants agree in virtues, which are contained in natural order. *Linnæus* gives examples of ſuch an agreement *, to wit, "*The pillar-bearing* (*columniferæ*) *plants*: "the Common Mallows, Marſh Mallows, Vervain "Mallows, and the Cotton Buſh. *The pleaſant* "*delicacies* (*Scitamina*): the Common Ginger, "Cardamoms, Galangal, Zedoary, Coſtus, Grains "of Paradiſe, and Turmerick. *The orchideous*: "the Purple Bird's Neſt (*Orchis*), Satyrion, Baſ-"tard Hellebore (*Serapias*), and Epidendrum. "*The many-podded*: the Peony, Columbines, "Wolf's-Bane, Staves Acre, Nigella, Hellebore, "Ranunculus, and Paſque-Flower. *The contort-*"*ed*: the Swallow-Wort (*Apocynum*), Cynanche, "Syrian Dog's-Bane (*Aſclepias*), &c." But though ſuch an agreement ſhould really exiſt in theſe, it does not thence follow, that of conſequence it is to be found in all others, or in a great number of them: eſpecially ſince one plant can ſcarce differ more

* *Phil. Bot. p.* 278.

more in virtues from another, than the Swallow-Wort from the Syrian Dog's-Bane, the Peony from the Columbines, and both of them from the Wolf's-Bane, Nigella, Hellebore, and Ranunculus; as alſo theſe among themſelves; nor truly do the Grains of Paradiſe come near to the Turmerick in virtues. But if we inſpect thoſe *orders*, which he has propoſed * as the fragments of natural method, there are placed under the ſame natural order, the Wake-Robin, ſweet Flag, and Red Nightſhade; the true Saffron and Meadow-Saffron; the Squil and Hyacinth; the Flower-de-luce and Corn-Flag; the Lily and Tulip; the Piſtachio Tree and Oak; the Elder and the Sumach; the Fig-Tree and Hemp; the Baſtard Saffron and Artichoke; the Colt's-Foot and Leopard's-Bane; the Sea-Holly and Hemlock; the Olive Tree and Aſh; the Bay Tree and Biſtort; the Guinea Pepper and Mullein; and a great many more included under the ſame order, which are found to be as different in their virtues, as are aliments, medicines, and poiſons; or one claſs of ſimples from another.

"Thoſe that have an affinity (ſays Mr. *Linnæus*) agree in habit, manner of growing, properties, virtues, and uſe. The daily labour of the greateſt Botaniſts is employed ſtrenuouſly about theſe, and it ſhould be ſtrenuouſly employed about them. Hence *natural method* is, and will be, the ultimate end of Botany †." But, whoever has ſeen ſuch an affinity betwixt the genera of almoſt any one of the mentioned orders, ſees much more clearly than me. For, if the Willow

* *Phil. Bot. p.* 27. *ad* 35.

† *Phil. Bot. p.* 137.

Willow and Plane Tree; the Mulberry Tree and Pellitory of the wall; the Common Heath and Strawberry Tree; the Jew's Mallow and Lime Tree; the Water-Elder and Holm-Oak; the Honey Flower and Fumitory; the Poppy and May Apple, and many others, agree in habit, I willingly acknowledge that I am ignorant of what is meant by an agreement in habit.

97. Concerning that *natural* method, "the "first and laſt thing wanted in Botany *," it may by the by be obſerved, as it here occurs; 1ſt, That, if we may be allowed to judge of it from the recited *fragments*, it will appear to be abſolutely uſeleſs to thoſe, that delight more in the knowledge of plants, than in a multitude of names. For, to what purpoſe is it to form artfully in a different manner thoſe vicarious names (as he calls them), which are to be changed of neceſſity, ſuch as *Piperitæ*, *Scitamina*, *Sepiariæ*, *Calamariæ*, *Scabridæ*, *Culmineæ*, *Vaginales*, *Sarmentaceæ*, *Candelares*, &c.? or, even the orders themſelves, whoſe genera are ſo little allied? Since they by no means facilitate the ſcience, which has been hitherto almoſt intirely loſt amidſt a ſuperfluous variety of terms, methods, &c. For, the Botanical language, (as the moſt famous *Buffon* remarks) is, in our times, much more difficultly acquired, than the knowledge of the plants themſelves; which is in a great meaſure owing to the ſchool at *Upſal*, or rather to the unfortunate ſexual ſyſtem.

98. And,

* *Phil. Bot. p.* 27.

98. And, 2dly, If I may be permitted to ſpeak my ſentiments, thoſe that are laboriouſly engaged in inveſtigating a *natural* method of plants, ſeem to be laboriouſly engaged in finding out the philoſopher's ſtone, ſince nature is only ſolicitous about the ſpecies: and hence it is, that all endeavours hitherto directed to this ſcope, have miſcarried. And indeed I am afraid leſt the celebrated author of the Philoſophia Botanica, now diſdaining the ſexual ſyſtem, ſhould contrive a new revolution of the Botanical Art. For, even in the Fund. Bot. § 209, he ſays, "To adhere ſo to the habits "of plants, that the rightly drawn principles of "fructification may be laid down, is to ſeek *folly* "*inſtead of wiſdom.*" And elſewhere (§ 168.), he adviſes the habit only to be conſulted *occultly*. Now he ſeems in ſome meaſure to be of a different opinion: for, in treating of the natural method, that *ultimate end of Botany* *, he adds, "Princi-"pally three obſtacles have put a bar in the way "of the natural method: 1. The neglected *Habit* "of plants, after the doctrine of fructification was "improved, eſpecially the new *foliation*, p. 105. "&c." And in the before cited place, he talks in this ſtrain: "The Foliation is that folded "form which *the leaves* keep, while they are hid "betwixt the gem and the young ſhoots (*aſparagi*) "of plants. This, which was overlooked by our "predeceſſors, is modelled in the following ten "manners, *Involuta*, *Revoluta*, *Obvoluta*, *Convo-*"*luta*, *Imbricata*, *Equitantia*, *Conduplicata*, *Pli-*"*cata*, *Reclinata*, *Circinalia*." Yea, in the Fund. Bot.

* *Phil. Bot. p.* 137.

Bot. § 163. he has fully commented on the Habit from p. 101. to 112. of his Philoſophia Botanica, where indeed many things very lately diſcovered are to be met with, yet ſcarce any of them are very uſeful.

99. "The taſte, ſmell, and colour, point out "thoſe qualities of plants, in which their virtues "conſiſt," Fund. Bot. § 358. Concerning the uſe of the ſenſes, eſpecially *Taſting*, in diſcovering the virtues of plants, many things occur in various authors. But no one ſeems to have carefully enough obſerved the differences of *taſtes*; and likewiſe ſome compound are eſteemed ſimple taſtes, and others that only differ in degree are reckoned diſtinct ſpecies of them. Wherefore, our *Grew*, not being content with the doctrine delivered in the ſchools, after re-examining and nicely weighing the whole matter, has obſerved and diſtinguiſhed ſixteen different *ſpecies of ſimple taſtes*; from the conjunctions of theſe, almoſt innumerable *compound*; and their very various differences, with reſpect to their *degrees*, *duration*, and the *ſubject* which they affect. [See *Grew*'s treatiſe *on the differences and cauſes of taſtes*, publiſhed in his *Anatomy of Plants*, or *Ray*'s Hiſt. Pl. from p. 46. to 50.] Whoever will examine the taſtes of plants, in *Grew*'s manner which has been hitherto neglected, will in a great meaſure find out the virtues of very many, but by no means of all plants.

The conſideration of ſmells is alſo in ſome degree uſeful, though more rarely. "The *Ambro-* "*ſiac* (*Sweet*), are Analeptics, the Fragrant,

" Orgaſtics (Cordials), the *Aromatics* ſtimulants, " the diſagreeably ſmelling (tetra) ſtupefying, the " *Nauſeous* corroſives," Fund. Bot. § 362. And according to the Philoſophia Botanica, p. 284, The *Ambroſiac* are the *Squinancy wort* (*Aſperula*), *Abelmoſch*, *Musked Crane's-bill*, *Musk Mallows*, *Millet*, and *Aira*: and act like *Ambergreaſe*, *Musk*, and *Civet*. The *Fragrant*, flowers of Saffron, the Jaſmine, Violet, &c. and commend themſelves by their moſt agreeable ſmell. The *Aromatics*, the Bay Tree, Saſſafras, Camphor, &c. commonly agree in ſmell and taſte. The *Heavily Smelling* (*Graveolentia*), which are ſingular, are, the *Alliaceous*, Garlick, Water-Germander, Aſſa fœtida, &c. The *Stinking* (Hircina), the Purple Bird's-Neſt (*Orchis*), ſtinking Hawkweed, ſtinking Orache, and Herb Robert. The *Tetra* are known very well by their diſagreeable ſmell; the ſtinking Mayweed, Opium, Elder, &c. The *Nauſeous*, or ſuch as when taken into the ſtomach are thrown up by nature; the white Hellebore, Bear's Foot, Lily of the Valley (Convallaria), Aſarabacca, Tobacco, and Coloquintida. Thus this aphoriſm is explained by the moſt famous author. But how theſe nauſeous things, are to be called *corroſives*; or the Tetra, ſtupefacient; or in what theſe Ambroſiac, Fragrant, and Aromatic ſubſtances agree among themſelves, I by no means ſee. For, if I be not miſtaken, the flowers of the Mezereon, Daffodill, Hyacinth, &c. may with equal reaſon be called Ambroſiac, (for this is an uncommon term), or at leaſt Fragrant, as thoſe above mentioned, how much ſoever they differ in virtues.

In

In a word, whoever takes the virtues of plants, from the taſte and ſmell, and much more from their colour and native place, will be very often led into error. But ſuch plants as agree exactly, in fructification, as well as in taſte and ſmell, are very ſeldom obſerved hitherto to differ in virtues.

100. Concerning the *Culture* of vegetables I have nothing to add. My moſt worthy friend, *Philip Miller*, Fellow of the Royal Society, has gained this province, and adorns it, in his learned *Gardener's Dictionary*, which is in every one's hands. "*Miller*'s Gardener's Dictionary, ſays "*Linnæus*, (in Phil. Bot. p. 263.) delivers the "particular culture of each plant; but this Me-"thod of horticulture would be too diffuſed and "troubleſome through all the diſcovered ſpecies "of plants. The foundation of *Horticulture* de-"pends upon the native place of plants, whence "the rules and principles of the art are to be "formed." Yet, it is manifeſt from experience, that a great many plants can bear our winters, and thrive much in gardens, whoſe native place differs greatly from ours, both in weather and ſoil: and howſoever *diffuſed and troubleſome the method* of the Dictionary *is*, the culture of more plants is there deſcribed, than I think are nurſed in any garden in *Europe*; and at the ſame time, in ſhort, it is to be found more eaſily and ſooner, than it can be inveſtigated in any other author, or with the aſſiſtance of the rules laid down in the Philoſophia Botanica, from p. 263. to 270. And hence it is, that the dictionary has been printed within

about twenty years ſix times; and its abridgment four times.

§ XXV.

Since all thoſe that rightly treat of the method of ſtudying medicine, extol Botany in the higheſt manner, and its diſcipline or inſtruction is not leſs friendly to the body, than neceſſary to the mind, it is needleſs to enlarge here on the celebration of its praiſes. I have however judged it proper, to give a general view of plants according to *Tournefort*'s method, to aſſiſt the memory: And leſt the Index ſhould be drawn out to too great length, from the order of the plants being needleſsly interrupted, I ſhall ſubjoin the titles of the claſſes and ſections, a little abbreviated; alſo the names of the genera deſcribed by him, with ſome others more recently diſcovered; and add the generical names of *Linnæus* which differ from thoſe of *Tournefort*.

Herbs and under-ſhrubs are, either Anthophorous, ſuch as bear flowers, or Ananthous, ſuch as bear no flowers. The anthophorous are either Petalodes, furniſhed with flower-leaves, or Apetalous, want flower-leaves. The petalodes have either a Simple or a Compound flower. Thoſe that carry a ſimple flower are either Monopetalous, ſuch as have only one flower-leaf, (though, without an accurate examination of it at the bottom, it is ſometimes much divided into laciniæ or jags, and ſo apparently conſiſts of ſeveral petala), or Polypetalous, ſuch as carry many flower-leaves.

The

The monopetalous are, the Campaniform, bell-ſhaped, *Claſs* 1. Infundibuliform, funnel like, or Rotated, wheel-ſhaped, *Claſs* 2. Labiated, ſuch as reſemble lips, *Claſs* 3. and Anomalous, ſuch as are irregularly ſhaped, and cannot for this reaſon be eaſily reduced under a particular name to any of the former claſſes, *Claſs* 4. The polypetalous are, the Cruciform, croſs-like, *Claſs* 5. Roſaceous, roſe-like, *Claſs* 6. Umbellated, umbelliferous, or reſemble an umbella or umbrella, *Claſs* 7. Caryophyllæous, july-flower-like, *Claſs* 8. Liliaceous, lily-like, *Claſs* 9. Papilionaceous, ſuch as have ſome faint ſimilitude to a butter-fly, *Claſs* 10. and Anomalous, ſuch as cannot well be diſtinguiſhed by names and brought under the foregoing claſſes on account of their ſingular figures, *Claſs* 11. Thoſe that bear a compound flower are, the Floſcular, ſuch as have many ſmall tubular petala, *Claſs* 12. Semifloſcular, ſuch as have many ſmall petala, but longer than the former, broader, flatter, and not apparently fiſtular, *Claſs* 13. and Radiated, *Claſs* 14. which are compoſed of an internal or central floſcular and an external or circumferential ſemifloſcular part, the latter being diſpoſed like rays of light and horizontally; the interior part is called diſcus, from its reſemblance of an horſe-ſhoe, and the exterior corona, from its diſtant likeneſs to a crown. The Apetalous, conſtitute *Claſs* 15. The ananthous are, either Spermatophorous, ſuch as produce ſeed, or Aſpermous, ſuch as are commonly reckoned to produce no ſeed. The Spermatophorous, make up *Claſs* 16. and the Aſpermous, form *Claſs* 17. Trees and Shrubs are, either Apetalous, or Petalodes. The apetalous are,

are, the Stamineous, ſuch as bear flowers, conſiſting of threads, *Claſs* 18. and Amentaceous, juliferous, ſuch as bear amenta, juli, or catkins, *Claſs* 19. The petalodes are, the Monopetalous, *Claſs* 20. Roſaceous, *Claſs* 21. and Papilionaceous, *Claſs* 22.

CLASS I.

Herbs monopetalous campaniform.

1. *With a piſtillum which changes into a ſoft fruit.*

Mandragora.
Belladona. *Atropa.*
Lilium convallium. *Convallaria.*
Polygonatum. *Convallaria.*
Ruſcus.

2. *With a piſtillum which changes into a dry fruit.*

Cerinthe.
Gentiana.
Hydrophyllon.
Soldanella.
Convolvulus.
Cuſcuta.
Tithymalus. *Euphorbia.*
Tithymaloides. *Euphorbia.*
Euphorbium. *Euphorbia.*
Manihot. *Jatropha.*
Glaux.
Oxys. *Oxalis.*

3. *With a piſtillum which changes into a ſingle ſeed.*

Rhabarbarum.

4. *With a piſtillum which changes into a fruit, compoſed of ſmall ſheaths or follicles.*

Cotyledon.
Apocynum.
Periploca.
Aſclepias.

5. *With a piſtillum, which is ſurrounded with the ſtamina united at their baſe into a tube, and changes into a multicapſular fruit.*

Malva.
Althæa.
Alcea.
Malacoides. *Malope.*
Lavatera.
Abutilon.

Abutilon. *Sida.*
Ketmia. *Hibiſcus.*
Xylon. *Goſſipium.*

6. *With a calyx which changes into a fruit, for moſt part fleſhy.*

Bryonia.
Tamnus. *Tamus.*
Sicyoides. *Sicyos.*
Momordica.
Luffa. *Momordica.*
Cucumis.
Melo. *Cucumis.*
Pepo. *Cucurbita.*
Melopepo. *Cucurbita.*
Cucurbita.
Anguria. *Cucurbita.*
Colocynthis. *Cucumis.*

7. *With a calyx which changes into a dry fruit.*

Campanula.
Rapunculus. *Phyteuma.*
Valantia.

8. *With a calyx which changes into a twin fruit.*

Rubia.
Aparine.
Gallium. *Galium.*
Cruciata. *Galium.*

CLASS II.

Herbs monopetalous infundibuliform, and rotated.

1. *With a piſtillum which changes into the fruit.*

Quamoclit. *Ipomœa.*
Menyanthes.
Nicotiana.
Hyoſcyamus.
Stramonium. *Datura.*
Pervinca. *Vinca.*
Auricula Urſi. *Primula.*
Plantago.
Coronopus. *Plantago.*
Pſyllium. *Plantago.*

2. *With a calyx which changes into the fruit.*

Jalapa. *Mirabilis.*
Rubeola. *Aſperula.*
Trachelium.
Valeriana.
Valerianella. *Valeriana.*
Ananas. *Bromelia.*

3. *With a piſtillum which changes into a fruit, conſiſting of four naked ſeeds.*

Borrago.
Bugloſſum.

Buglossum. *Anchusa.*
Asperugo.
Echium.
Echioides. *Lycopsis.*
Pulmonaria.
Lithospermum.
Symphytum.
Heliotropium.
Cynoglossum.
Omphalodes. *Cynoglossum.*

4. *With a pistillum which changes into a single seed.*

Plumbago.

5. *Rotated, with a pistillum which changes into a dry fruit.*

Lysimachia.
Hottonia.
Anagallis.
Samolus.
Veronica.
Chrysosplenium.
Polemonium.
Verbascum.
Blattaria. *Verbascum.*
Polygonoides. *Calligonum.*

6. *Rotated, with a pistillum which changes into a soft fruit.*

Solanum.
Lycopersicon. *Solanum.*
Alkekengi. *Physalis.*
Melongena. *Solanum.*
Capsicum.
Nymphoides. *Menyanthes.*
Cyclamen.
Moschatellina. *Adoxa.*

7. *Rotated, with a calyx which changes into the fruit.*

Pimpinella.

CLASS III.

Herbs monopetalous labiated.

1. *With the upper lip bent like a helmet or falcion.*

Phlomis.
Horminum. *Salvia.*
Sclarea. *Salvia.*
Salvia.
Dracocephalon. *Dracocephalum.*
Cassida, *Scutellaria.*
Brunella.

2. *With the upper lip hollowed like a spoon.*

Lamium.

Moldavica.

Moldavica. *Dracocephalum.*
Ballote. *Ballota.*
Galeopsis.
Stachys.
Cardiaca. *Leonurus.*
Leonurus.
Molucca. *Moluccella.*
Pseudodictamnus. *Marrubium.*
Mentha.
Marrubiastrum. *Cunila.*
Lycopus.

3. *With the upper lip erect.*

Sideritis.
Marrubium.
Melissa.
Calamintha. *Melissa.*
Clinopodium.
Rosmarinus.
Thymus.
Serpyllum. *Thymus.*
Satureia.
Thymbra. *Satureia.*
Lavendula.
Origanum.
Majorana. *Origanum.*
Verbena.
Hyssopus.
Stœchas. *Lavendula.*
Cataria. *Nepeta.*
Betonica.
Ocimum.

4. *Such as have but one lip.*

Chamædrys. *Teucrium.*
Polium. *Teucrium.*
Teucrium.
Chamæpitys. *Teucrium.*
Bugula. *Teucrium.*

CLASS IV.

Herbs monopetalous anomalous.

1. *With a flower that hath a long ear, or hood.*

Arum.
Dracunculus. *Dracontium.*
Arisarum. *Arum.*

2. *With a tubular flower, ending in a tongue.*

Aristolochia.
Rapuntium. *Lobelia.*

3. *With a flower open at both ends.*

Bignonia.
Digitalis.
Scrophularia.
Pinguicula.

4. *With a tubular flower, and perſonated or reſembling a vizard or mask.*

Antirrhinum.
Linaria. *Antirrhinum.*
Phelypæa.
Morina.
Aſarina. *Antirrhinum.*
Ageratum. *Erinus.*
Pedicularis.
Melampyrum.
Chelone.
Euphraſia.
Polygala.
Chamæbuxus. *Polygala.*
Adhatoda. *Juſticia.*
Coris.
Clandeſtina. *Lathræa.*
Orobanche.
Dodartia.
Anblatum. *Squamaria.*
Elephas. *Rhinanthus.*

5. *With the flower ending in a ring.*

Acanthus.

CLASS V.

Herbs tetrapetalous cruciform.

1. *With an unicapſular fruit, but not husked, or podded.*

Jonthlaſpi. *Clypeola.*
Rapiſtrum. *Myagrum.*
Myagrum.
Iſatis.
Crambe.
Cakile. *Raphanus.*
Veſicaria. *Alyſſum.*

2. *With a pretty ſhort fruit, divided into two parts, by an intermediate partition, with reſpect of the valves, placed obliquely to the perpendicular.*

Thlaſpi.
Naſturtium. *Lepidium.*
Thlaſpidium. *Biſcutella.*
Cochlearia.
Lepidium.
Burſa paſtoris. *Thlaſpi.*

3. *With the fruit, divided into two parts, by an intermediate partition, parallel to the valves.*

Alyſſon. *Alyſſum.*
Alyſſoides. *Alyſſum.*
Lunaria.

4. *With a bicapſular fruit, and husked, or podded.*

Braſica.
Leucoium. *Cheiranthus.*
Heſpe-

Hesperis.
Turritis.
Cardamine.
Dentaria.
Sisymbrium.
Eruca. *Brassica.*
Sinapi.
Erysimum.
Rapa. *Brassica.*
Napus. *Brassica.*
Raphanus.

5. *With a jointed husk.*

Raphanistrum. *Raphanus.*
Hypecoon. *Hypcoum.*

6. *With an unicapsular husk.*

Chelidonium.
Sinapistrum. *Cleome.*
Epimedium.

7. *With the fruit divided into three or four cells.*

Erucago. *Bunias.*

8 *With the fruit consisting of seeds collected into a small head.*

Potamogeton.

9. *With a soft fruit.*

Herba Paris. *Paris.*

CLASS VI.

Herbs rosaceous.

1. *With a pistillum which changes into an unicapsular fruit, opening two ways transversely.*

Amaranthus.
Portulaca.

2. *With a pistillum which changes into an unicapsular fruit.*

Papaver.
Argemone.
Anapodophyllon. *Podophyllum.*
Opuntia. *Cactus.*
Melocactus. *Cactus.*
Cereus. *Cactus.*
Ficoides. *Mesembryanthemum.*
Granadilla. *Passiflora.*
Murucuia. *Passiflora.*
Mitella.
Leontopetalon. *Leontice.*
Alsine.
Alsinastrum. *Elatine.*
Myosotis. *Cerastium.*
Ros Solis *Drosera.*
Parnassia.
Juncus.
Kali. *Salsola.*
Telephium.

Tribuloides. *Trapa.*
Helianthemum. *Ciſtus.*
Androſæmum. *Hypericum.*

3. *With a piſtillum which changes into the fruit for moſt part bicapſular.*

Geum. *Saxifraga.*
Saxifraga.
Salicaria. *Lythrum.*
Glaucium. *Chelidonium.*

4. *With a piſtillum which changes into a multicapſular fruit.*

Chamelæa. *Cneorum.*
Hypericum.
Aſcyrum. *Hypericum.*
Sarracena.
Pyrola.
Damaſonium. *Aliſma.*
Orobanchoides. *Monotropa.*
Ruta.
Harmala. *Peganum.*
Nigella.
Garidella.
Fabago. *Zygophyllum.*
Corchorus.
Hermania.
Telephioides. *Andrachne.*
Ciſtus.
Nymphæa.

5. *With a piſtillum which changes into a fruit, in which the ſeeds are lodged as it were in neſts.*

Nelumbo. *Nymphæa.*
Capparis.

6. *With a piſtillum which changes into a fruit, compoſed of many capſulæ.*

Sedum.
Anacampſeros. *Sedum.*
Ulmaria. *Filipendula.*
Barba capræ. *Aruncus.*
Fagonia.
Tribulus.
Juncago. *Triglochin.*
Geranium.
Thalictrum.
Butomus.
Helleborus.
Veratrum.
Populago. *Caltha.*
Pæonia.

7. *With a piſtillum which changes into a fruit, compoſed of many ſeeds collected into a ſmall head.*

Ane-

Anemone. *Pulſatilla.*
Pulſatilla.
Ranunculus.
Filipendula.
Clematitis. *Clematis.*
Caryophyllata. *Geum.*
Fragaria.
Quinquefolium. *Potentilla.*
Tormentilla.
Pentaphylloides. *Potentilla.*

8. *With a ſoft fruit.*

Chriſtophoriana. *Actæa.*
Phytolacca.
Solanoides. *Rivinia.*
Aralia.
Aſparagus.
Smilax.
Meniſpermum.

9. *With a calyx which changes into a dry fruit.*

Cuminoides. *Lagœcia.*
Circæa.
Agrimonia.
Agrimonoides. *Agrimonia.*
Onagra. *Oenothera.*
Chamænerion. *Epilobium.*

10. *With a fruit ſeparated from the flower.*

Ricinoides. *Croton.*
Begonia.
Morſus Ranæ. *Hydrocharis.*

CLASS VII.

Herbs umbellated.

1. *With ſmall and ſtriated ſeeds.*

Ammi.
Apium.
Cicuta. *Conium.*
Carvi. *Carum.*
Phellandrium.
Bulbocaſtanum. *Bunium.*
Daucus.
Sium.
Siſarum *Sium.*
Tragoſelinum. *Pimpinella.*
Bupleurum.

2. *With narrow, oblong, and pretty thick ſeeds.*

Fœniculum. *Anethum.*
Meum. *Athamanta.*
Oenanthe.
Angelica. *Ægopodium.*
Aſtrantia.
Chærophyllum.
Myrrhis. *Chærophyllum.*

3. *With*

3. *With roundish and thickish seeds.*

Smyrnium.
Coriandrum.

4. *With plane, oval, and pretty large seeds.*

Imperatoria, *et Angelica.*
Crithmum.
Anethum.
Peucedanum.

5. *With oval, plane, large seeds.*

Oreoselinum. *Selinum.*
Thysselinum. *Selinum.*
Pastinaca.
Sphondylium. *Heracleum.*
Tordylium.
Ferula.
Thapsia.

6. *With large seeds, whose striæ are deeply hollowed.*

Cicutaria. *Ligusticum.*
Caucalis.
Echinophora. *Caucalis.*
Ligusticum.
Laserpitium.

7. *With seeds covered with a spongy bark.*

Cachrys.

8. *With seeds ending in a long tail.*

Scandix.

9. *With umbells rolled up into a small head.*

Sanicula.
Eryngium.
Hydrocotyle.

CLASS VIII.

Herbs caryophyllæous.

1. *With a pistillum which changes into the fruit.*

Caryophyllus.
Lychnis.
Cucubalus.
Linum.

2. *With a pistillum which changes into the seed, wrapt up in the calyx.*

Statice.
Limonium.

CLASS IX.

Herbs liliaceous.

1. *Monopetalous, with a pistillum*

pistillum which changes into the fruit.

Asphodelus.
Lilio-Asphodelus. *Hemerocallis.*
Hyacinthus.
Muscari. *Hyacinthus.*
Colchicum.
Bulbocodium. *Crocus.*

2. *Monopetalous, with a calyx which changes into the fruit.*

Crocus.
Narcissus.
Iris.
Xiphion. *Iris.*
Hermodactylus. *Iris.*
Sisyrinchium. *Iris.*
Gladiolus.
Aloe.
Yucca.
Cannacorus. *Canna.*
Zingiber. *Amomum.*
Hæmanthus.

3. *Tripetalous.*

Ephemerum. *Tradescantia.*
Aloides. *Stratiotes.*

4. *Hexapetalous, with a pistillum which changes into the fruit.*

Phalangium. *Anthericum.*
Liliastrum. *Hemerocallis.*
Lilium.
Lilio-Hyacinthus. *Scilla.*
Corona Imperialis. *Petilium.*
Tulipa.
Fritillaria.
Dens Canis. *Erythronium.*
Methonica. *Gloriosa.*
Ornithogalum.
Aphyllanthes.
Porrum.
Cepa.
Allium.

5. *Hexapetalous, with a calyx which changes into the fruit.*

Lilio-Narcissus. *Amaryllis.*
Narcisso-Leucoium. *Leucoium.*
Bermudiana. *Sisyrinchium.*

CLASS X.

Herbs papilionaceous, or leguminous.

1. *With a short unicapsular pod, or husk.*

Gly-

Glycyrrhiza.
Cicer.
Lens. *Cicer.*
Onobrychis. *Hedyſarum.*
Vulneraria. *Anthyllis.*
Dorycnium.

2. *With a long unicapſular pod.*

Faba.
Lupinus.
Orobus.
Piſum.
Lathyrus.
Clymenum. *Lathyrus.*
Niſſolea.
Ochrus. *Piſum.*
Vicia.
Ervum.
Galega.
Aſtragaloides. *Phaca.*
Aphaca. *Lathyrus.*
Ternatea. *Clitoria.*

3. *With a jointed pod.*

Securidaca. *Coronilla.*
Ornithopodium. *Ornithopus.*
Ferrum equinum. *Hippocrepis.*
Hedyſarum.
Scorpioides. *Scorpius.*

4. *Three-leaved.*

Lotus.
Trifolium.
Melilotus. *Trifolium.*
Anonis. *Ononis.*
Fœnum Græcum *Trigonella.*
Medica. *Medicago.*
Medicago.
Phaſeolus.

5. *With a bicapſular pod.*

Aſtragalus.
Tragacantha.
Pelecinus. *Biſerrula.*

CLASS. XI.

Polypetalous anomalous.

1. *With a piſtillum which changes into an unicapſular fruit.*

Balſamina. *Impatiens.*
Viola.
Fumaria.
Capnoides. *Fumaria.*
Reſeda.
Luteola. *Reſeda.*

2. *With a piſtillum which changes*

changes into an unicapsular fruit.

Sesamoides. *Reseda.*
Aconitum.
Delphinium.
Aquilegia.
Fraxinella. *Dictamnus.*
Cardamindum. *Tropæolum.*
Melianthus.
Corindum. *Cardiospermum.*

3. *With a calyx which changes into the fruit.*

Orchis.
Helleborine. *Serapias.*
Calceolus. *Cypripedium.*
Limodorum. *Orchis.*
Ophris. *Ophrys.*
Nidus avis. *Neottia.*

CLASS XII.

Herbs Floscular.

1. *With a flower separated from the fruit.*

Xanthium.
Ambrosia.
Gnaphalodes. *Micropus.*

2. *With downy seed.*

Carduus.
Cinara. *Cynara.*
Jacea. *Centaurea.*
Cyanus. *Centaurea.*
Cirsium. *Carduus.*
Centaurium majus. *Centaurea.*
Lappa. *Arctium.*
Cnicus.
Petasites. *Tussilago.*
Cacalia. *Tussilago.*
Elichrysum. *Gnaphalium.*
Filago. *Gnaphalium.*
Conyza.
Eupatorium.
Senecio.

3. *With seed not downy.*

Carthamus.
Absinthium. *Artemisia.*
Abrotanum. *Artemisia.*
Artemisia.
Santolina.
Gnaphalium.
Tanacetum.
Conyzoides. *Erigeron.*
Bidens.

4. *With floscules placed in their own calyx, and divided into equal jags.*

Echinopus.

Amaranthoides *Gomphræna.*

5. *With floſcules placed in their own calyx, and for moſt part divided into unequal jags.*

Scabioſa.
Lychniſcabioſa. *Knautia.*
Dipſacus.
Gundelia.
Globularia.

CLASS XIII.

Herbs ſemifloſcular.

1. *With downy ſeed.*

Dens Leonis. *Leontodon*, &c.
Hieracium, &c.
Lactuca.
Sonchus, &c.
Chondrilla.
Zacintha. *Lapſana.*
Scorzonera.
Tragopogon.

2. *With ſeed not downy.*

Catanance. *Catananche.*
Hedypnois. *Lapſana.*
Cichorium.
Lampſana. *Lapſana.*
Rhagadiolus. *Lapſana.*
Scolymus.

CLASS XIV.

Herbs radiated.

1. *With downy ſeed.*

Aſter. *Inula*, &c.
Virga aurea. *Solidago.*
Jacobæa. *Senecio.*
Tuſſilago.
Doronicum.

2. *With ſeeds furniſhed with a ſmall leaved head.*

Tagetes.
Anemonoſpermos. *Arctotis.*
CoronaSolis. *Helianthus.*

3. *With ſeed without down and a ſmall leaved head.*

Bellis.
Chryſanthemum.
Leucanthemum. *Chryſanthemum.*
Matricaria.
Chamæmelum. *Anthemis.*
Cotula.

Buph-

Buphthalmum.
Millefolium. *Achillea.*
Ptarmica. *Achillea.*
Afterifcus. *Buphthalmum.*
Afteroides. *Buphthalmum.*
Chryfanthemoides. *Oſteoſpermum.*

4. *With ſeeds lodged in a capſula.*

Caltha. *Calendula.*

5. *With a crown compoſed of plane petala.*

Xeranthemum.
Carlina.

CLASS XV.

Herbs apetalous.

1. *With a poſterior part of the calyx which changes into the fruit.*

Aſarum.
Hypociſtis. *Aſarum.*
Beta.

2. *With a piſtillum which changes into the ſeed, hood-wink'd in the calyx.*

Acetoſa. *Rumex.*
Lapathum. *Rumex.*
Atriplex.
Chenopodium.
Blitum. *Amaranthus.*
Herniaria.
Paronychia. *Herniaria.*
Alchimilla. *Alchemilla.*
Parietaria.
Camphorata. *Polycnemum.*
Perſicaria.
Polygonum.
Fagopyrum. *Helxine.*
Biſtorta.
Salicornia.

3. *Cereal, or Culmiferous, or ſuch as have ſtems with ears.*

Triticum.
Secale.
Hordeum.
Oryza.
Avena.
Milium. *Panicum.*
Panicum.
Gramen. *Triticum*, &c.
Arundo.

4. *With flowers collected into a ſmall, ſcaly head.*

Cyperus.

Scirpus.
Linagroſtis. *Eriophorum.*

5. *With a flower, in the ſame plant, ſeparated from the fruit.*

Cyperoides. *Carex.*
Typha.
Acorus.
Sparganium.
Mays. *Zea.*
Lachryma Job. *Coix.*
Ricinus.
Cynocrambe. *Theligonum.*
Lenticula. *Lemna.*

6. *With the flower in one, and the fruit for moſt part in another plant.*

Equiſetum.
Spinacia.
Mercurialis.
Ceratoides. *Urtica.*
Urtica.
Cannabis.
Cannabina. *Cannabis.*
Lupulus. *Humulus.*

CLASS XVI.

Herbs ananthous, ſpermatophorous.

1. *With a fruit which grows upon the leaves.*

Filix. *Pteris*, &c.
Lonchitis. *Polypodium.*
Trichomanes. *Aſplenium.*
Polypodium.
Ruta muraria. *Aſplenium.*
Filicula. *Polypodium.*
Adiantum.
Aſplenium.
Lingua Cervina. *Aſplenium.*
Hemionitis. *Aſplenium.*

2. *With a fruit which does not grow upon the leaves.*

Oſmunda.
Ophioglooſſum.
Lichen.

CLASS. XVII.

Herbs which are commonly thought to have neither flowers nor fruit.

1. *Such as grow on the land.*

Muſcus.
Fungus.

Fungus.
Fungoides
Boletus. *Phallus.*
Agaricus.
Lycoperdon.
Coralloides. *Clavaria.*
Tubera. *Lycoperdon.*

2. *Such as grow in the sea, or in rivers.*

Fucus.
Alga.
Acetabulum. *Sertularia.*
Corallina. *Sertularia.*
Corallum.
Madrepora.
Lithophyton. *Lithoxylum.*
Tubularia. *Tubipora.*
Spongia.
Eschara. *Millepora.*
Alcyonium.

CLASS XVIII.

Trees apetalous.

1. *With a flower conjoined with the fruit.*

Fraxinus.
Siliqua. *Ceratonia.*
Ficus.

2. *With a flower, in the same plant, separated from the fruit.*

Buxus.
Empetrum.

3. *With the flower in one, and the fruit for most part in another plant.*

Terebinthus. *Pistacia.*
Lentiscus. *Pistacia.*
Rhamnoides. *Hippophae.*
Ephedra.
Casia. *Osyris.*
Gale. *Myrica.*

CLASS XIX.

Trees amentaceous.

1. *With a flower, in the same plant, separated from a stony fruit.*

Nux. *Juglans.*
Corylus.
Carpinus.

2. *With a flower, in the same plant, for most part separated from the fruit, whose covering is coriaceous.*

Quercus.
Ilex. *Quercus.*
Suber.

Suber. *Quercus.*
Fagus.
Caſtanea. *Fragus.*

3. *With a flower, in the ſame plant, ſeparated from a ſcaly fruit.*

Abies.
Pinus.
Larix. *Abies.*
Thuya.
Cupreſſus.
Alnus.
Betula.

4. *With a flower ſeparated from a ſoft fruit.*

Cedrus. *Juniperus.*
Juniperus.
Sabina. *Juniperus.*
Taxus.
Morus.

5. *With a flower, in the ſame plant, ſeparated from a dry fruit.*

Platanus.

6. *With the flower in one plant, and the fruit in another.*

Salix.
Populus.

CLASS XX.

Trees monopetalous.

1. *With a piſtillum which changes into a ſoft fruit full of callous ſeeds.*

Rhamnus.
Thymelæa. *Daphne.*
Alaternus. *Rhamnus.*
Phillyrea.
Caſſine.
Liguſtrum.
Laurus.
Jaſminum.
Coffea.
Acajou. *Anacardium.*
Genipa.
Arbutus.

2. *With a piſtillum which changes into a fruit full of ſtony ſeeds.*

Styrax.
Olea.
Ahouai. *Thevetia.*
Uva Urſi. *Arbutus.*
Aquifolium. *Ilex.*
Guajacana. *Dioſpyrus.*

3. *With a piſtillum which changes into a membranaceous fruit.*

Ulmus.

4. *With*

4. *With a piſtillum which changes into a multicapſular fruit.*

Lilac. *Syringa.*
Alaternoides. *Celaſtrus.*
Erica.
Vitex.
Chamærhododendros. *Azalea.*

5. *With a piſtillum which changes into a husky fruit.*

Nerion. *Nerium.*
Plumeria.
Acacia. *Mimoſa*, &c.
Mimoſa.

6. *With a calyx which changes into a fruit, or berry.*

Sambucus.
Opulus. *Viburnum.*
Viburnum.
Tinus. *Viburnum.*
Vitis Idæa. *Vaccinium.*
Oxycoccus. *Vaccinium.*
Caprifolium. *Lonicera.*
Periclymenum. *Lonicera.*
Chamæceraſus. *Lonicera.*
Xyloſteon. *Lonicera.*
Diervilla.
Elæagnus.

7. *With the flower in one, and the fruit in another plant.*

Viſcum.

CLASS XXI.

Trees roſaceous.

1. *With a piſtillum which changes into an unicapſular fruit.*

Cotinus.
Toxicodendron. *Rhus.*
Rhus.
Molle. *Schinus.*
Tilia.
Tamariſcus. *Tamarix.*
Hippocaſtanum. *Eſculus.*

2. *With a piſtillum which changes into a ſingle, or manifold berry.*

Celtis.
Frangula. *Rhamnus.*
Hedera.
Vitis.
Berberis.
Rubus.

3. *With*

3. *With a piſtillum which changes into a multicapſular fruit.*

Acer.
Liquidambar.
Pavia.
Staphylodendron. *Staphylæa.*
Paliurus. *Rhamnus.*
Thea.
Azedarach. *Melia.*
Euonymus.
Syringa. *Philadelphus.*

4. *With a piſtillum which changes into a fruit, compoſed of little husks or ſeeds, collected into a ſmall head.*

Spiræa.
Tulipifera. *Liriodendrum.*
Magnolia.

5. *With a piſtillum which changes into a husky or podded fruit.*

Senna. *Caſſia.*
Poinciana.
Caſſia.
Tamarindus.

6. *With a piſtillum which changes into a fleſhy fruit, full of callous ſeeds.*

Aurantium. *Citrus.*
Citreum. *Citrus.*
Limon. *Citrus.*
Papaya. *Carica.*
Cacao. *Theobroma.*

7. *With a piſtillum which changes into a fruit filled with a ſmall ſtone.*

Prunus.
Armeniaca. *Prunus.*
Perſica. *Amygdalus.*
Ceraſus.
Amygdalus.
Sapindus.
Ziziphus. *Rhamnus.*
Oenoplia.
Myxa. *Cordia.*
Lauroceraſus. *Padus.*
Palma. *Phœnix.*

8. *With a calyx which changes into a fruit, filled with a ſingle ſeed.*

Caryophyllus aromaticus.

9. *With a calyx which changes into a fruit, full of callous ſeeds.*

Pyrus.

Pyrus.
Cydonia. *Pyrus.*
Cratægus.
Sorbus.
Malus. *Pyrus.*
Punica.
Guajava. *Pſidium.*
Roſa.
Groſſularia. *Ribes.*
Myrtus.

10. *With a calyx which changes into a fruit, full of ſmall ſtones.*

Cornus.
Meſpilus.

CLASS XXII.

Trees papilionaceous.

1. *With ſingle leaves, placed in an alternate or verticillate order.*

Geniſta.
Crotalaria.
Spartium.
Geniſta-Spartium. *Geniſta.*
Alhagi. *Hedyſarum.*
Erinacea.
Geniſtella. *Geniſta.*
Siliquaſtrum. *Cercis.*

2. *With three leaves which grow on a ſingle foot-ſtalk.*

Anagyris.
Corallodendron. *Erythrina.*
Cytiſus.
Cytiſo-Geniſta. *Spartium.*

3. *With Leaves in couples which grow for moſt part to the ſide.*

Pſeudoacacia. *Robinia.*
Colutea.
Emerus. *Coronilla.*
Coronilla.
Barba Jovis. *Anthyllis.*

To this methodical diſtribution of vegetables by *Tournefort*, in the *Tirocinium Botanicum*, the Doctor has annexed the *Fundamenta Botanica* of *Linnæus*, from the author's laſt edition in the *Philoſophia Botanica*, and *an Index of Plants*: But, as he obſerves that he only added the former, to aſſiſt the Students of this Art to be able to form a

better judgment, with what right a Novice may venture to diſſent from the moſt illuſtrious Botaniſts of the preſent Age; and, as the latter, contains a liſt of plants, chiefly the medicinal, nurſed in two Gardens at *Edinburgh*, which he ſometimes demonſtrates in the garden properly belonging to the City, and ſometimes in the royal garden adjoining to the King's palace, called *Holy-rood-houſe*, and is principally ſerviceable to thoſe that attend his Prælections and Demonſtrations; they are both here omitted.

THE END.